ATOMLAB 950 (PC) MEDICAL SPECTROMETER

SERVICE/OPERATION MANUAL

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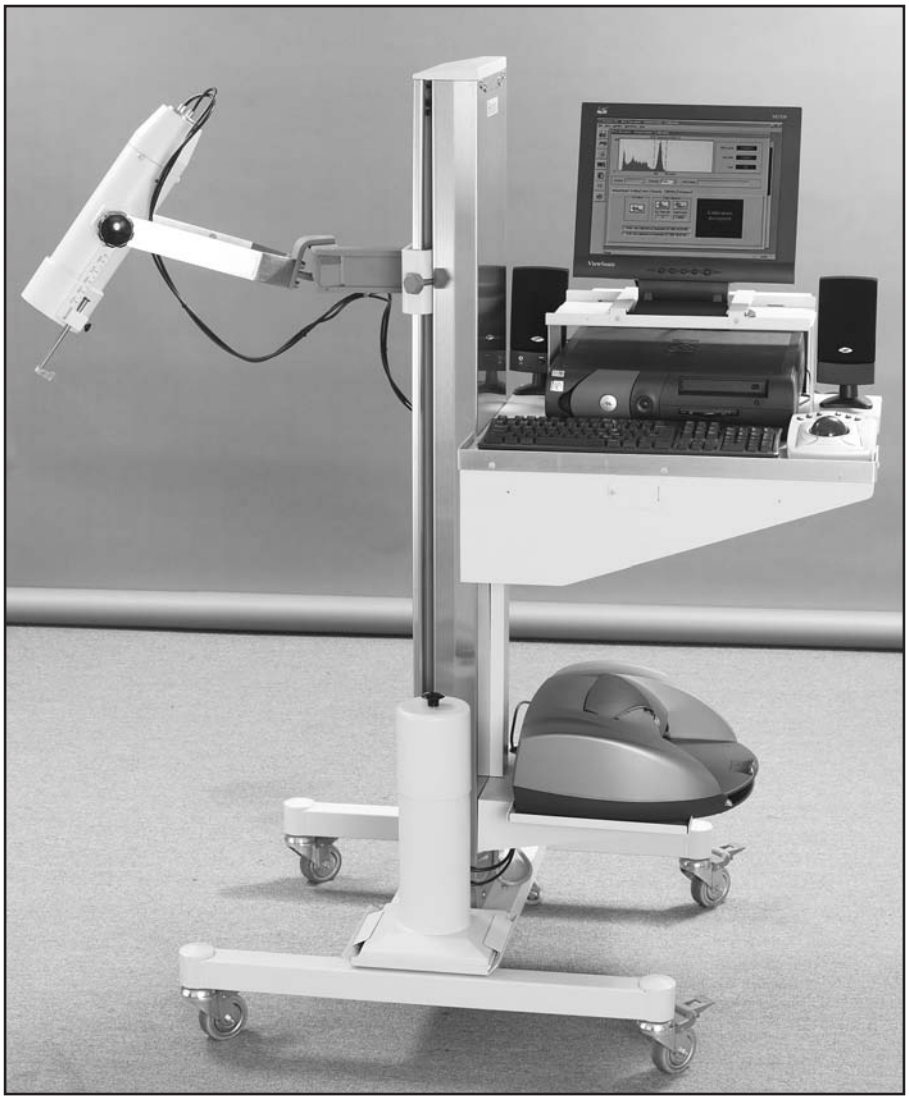
187-135
187-140
187-145



BIODEX

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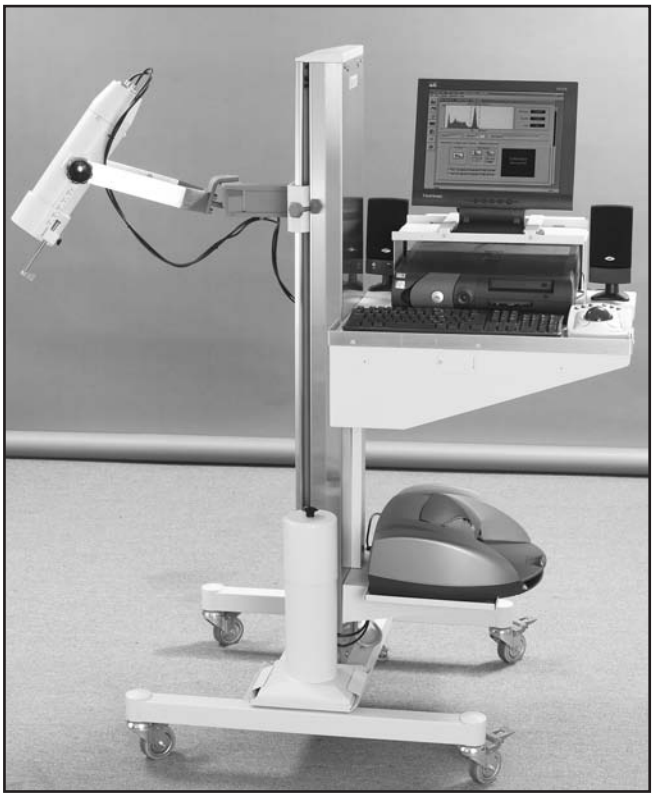
ATOMLAB 950 (PC)



This manual covers installation and operation procedures for the following Atomlab 950 products:

#187-130	115 VAC, Table Top, Thyroid Uptake System, Atomlab 950
#187-135	230 VAC, Table Top, Thyroid Uptake System, Atomlab 950
#187-140	115 VAC, Mobile, Thyroid Uptake System, Atomlab 950
#187-145	230 VAC, Mobile, Thyroid Uptake System, Atomlab 950

NOTE: All or some of the following symbols, cautions, warnings and notes may apply to your Atomlab 950 and correspond to this operation manual:

Symbol	***Meaning***
⚠	*Attention, consult accompanying documents.*
⚠	*Symbol signification: Attention, se référer à la notice.*
⚠	*Warning: Injuries to health may result from incorrect or excessive training.*
⚠	*Attention, incorrect ou extrême entrainement peut aboutir des lesíons au santé.*

NOTE: Circuit diagrams for this product are available upon request.

IMPORTANT NOTES

- Before you use this device, be certain to read the entire manual. Failure to read this manual may result in user error or inaccurate data.

- All activities and count values on the sample reports in this manual are for illustration purposes only. They do not represent actual study values.

WARRANTY

ATOMLAB Thyroid Uptake Systems carry the industry's best warranty.

Biodex Medical Systems backs Atomlab Thyroid Uptake Systems with a truly comprehensive full two-year warranty. It covers both parts and labor, and includes all unit elements. Biodex's two-year warranty is a sure sign of product quality and dependability.

With this two-year warranty, quality assurance, guaranteed delivery from stock, and responsive customer service, Biodex Medical Systems gives the nuclear medicine field the right answer… Atomlab Thyroid Uptake Systems.

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1. INTRODUCTION

The Atomlab 950 PC is a complete thyroid uptake and analysis system specifically designed for nuclear medicine. Capable of performing a full range of studies this system provides fast, accurate results for Uptake Studies, Bioassay, Wipe Testing, Schilling Tests programmed for the Mallinckrodt, Bracco, or Nycomed Dicopac® Schilling kits and Hematology testing.

The heart of the Atomlab 950 is a microprocessor-controlled 1024 channel Multi-Channel Analyzer, coupled to a 2" x 2" NaI(Tl) detector with a personal computer interface. The system offers simple, straight-forward operation using 23 pre-programmed isotopes, 50 user-defined radionuclides, and menu-driven prompts to guide the user step by step through each procedure. The pre-programmed radionuclides include I-123, I-125, I-131, Co-57, Cr-51, Tc-99m and Cs-137. The user-defined radionuclides also allow for isotope identification while the printer provides hard copy printouts for patient and department record keeping.

The Atomlab 950 has a memory allowing storage of 5,000 patients with multiple uptakes on each. Additional features include an automatic self-diagnostic program, automatic calibration mode, choice of automatic or manual counting time for uptake studies, and automatic isotope decay correction of uptake measurements. These features help make this the most simple and accurate thyroid uptake system available today.

2. SETUP INSTRUCTIONS

Assembly Procedure

(See Figures 2-1 and 2-2.)

Tools Required:
Knife
Wire cutter
Phillips screwdriver
Medium straight screwdriver
Small straight screwdriver
1/32" Allen key (included)
Adjustable wrench

NOTE: For Uptake Stands that have been shipped pre-wired, complete steps 1 through 5, 18 through 31, and steps 33 through 51. If you have a Well Counter, also complete steps 6 through 13, and step 17.

1. Remove the uptake stand from its shipping box and place in an area suitable for assembly and setup.

2. Determine how the unit will be positioned in the department where it is to be used. The computer, keyboard, CPU and monitor will need to be installed correspondingly, facing to either the left or right of the large shelf push bar on the stand. The normal configuration is the keyboard to the left of the push bar. This is how the stand is wired.

3. With a Phillips screwdriver, remove the four screws that hold the large shelf side cable cover to the side of the large shelf. Retain the screws. The cable cover is shipped strapped to the stand (not mounted).

4. If you desire to change the orientation, use a Phillips screwdriver to remove the six screws that hold the CPU bracket to the top of the large shelf. Remove the bracket and place it aside, retaining the screws.

   NOTE: Most users do not need to change the orientation and can, therefore, skip step 4.

5. The large shelf side cable hole cover should be positioned on the same side as the keyboard. If it is not, use a Phillips screwdriver to remove the screw that holds the cover to the large shelf. Remove the plastic gasket from the opposite side cable hole and position it on the hole from which the cover was just removed. Now take the large shelf side cable hole cover and install it on the opposite side (the side from which the plastic gasket was just removed).

   NOTE: The cables may be already installed into the stand.

6. With a Phillips screwdriver, remove the three screws that hold the vertical cable cover to the vertical column. Remove the vertical cable cover and place it aside, retaining the screws.

   NOTE: Remove the vertical cable cover only if you have a well counter or the stand is not pre-wired.

7. If you will be using the optional well counter with your system, ensure that the well support shelf is on the appropriate side of the stand. It should be positioned on the same side that the keyboard will be positioned. To move the well counter shelf to the opposite side, use a medium slotted screwdriver to remove the four screws that hold the well support shelf in place, remove the shelf and replace the screws. Now remove the four screws on the other side of the vertical column and use these to secure the well.

8. Using a small Phillips screwdriver, remove the two screws that hold either of the well hold down support brackets to the well support shelf. Remove this bracket, then loosen the screws on the remaining bracket so that the bracket has a small degree of play.

9. Remove the well counter and two cables (located in the base) from their shipping carton. Slide the well counter onto the well shelf so that the cable connectors are facing in the same direction as the large shelf push bar. Ensure that the well support bracket which is still attached to the well support shelf is positioned over the edge of the well counter base. With a Phillips screwdriver, tighten the two screws to secure the well support bracket over the well counter base.

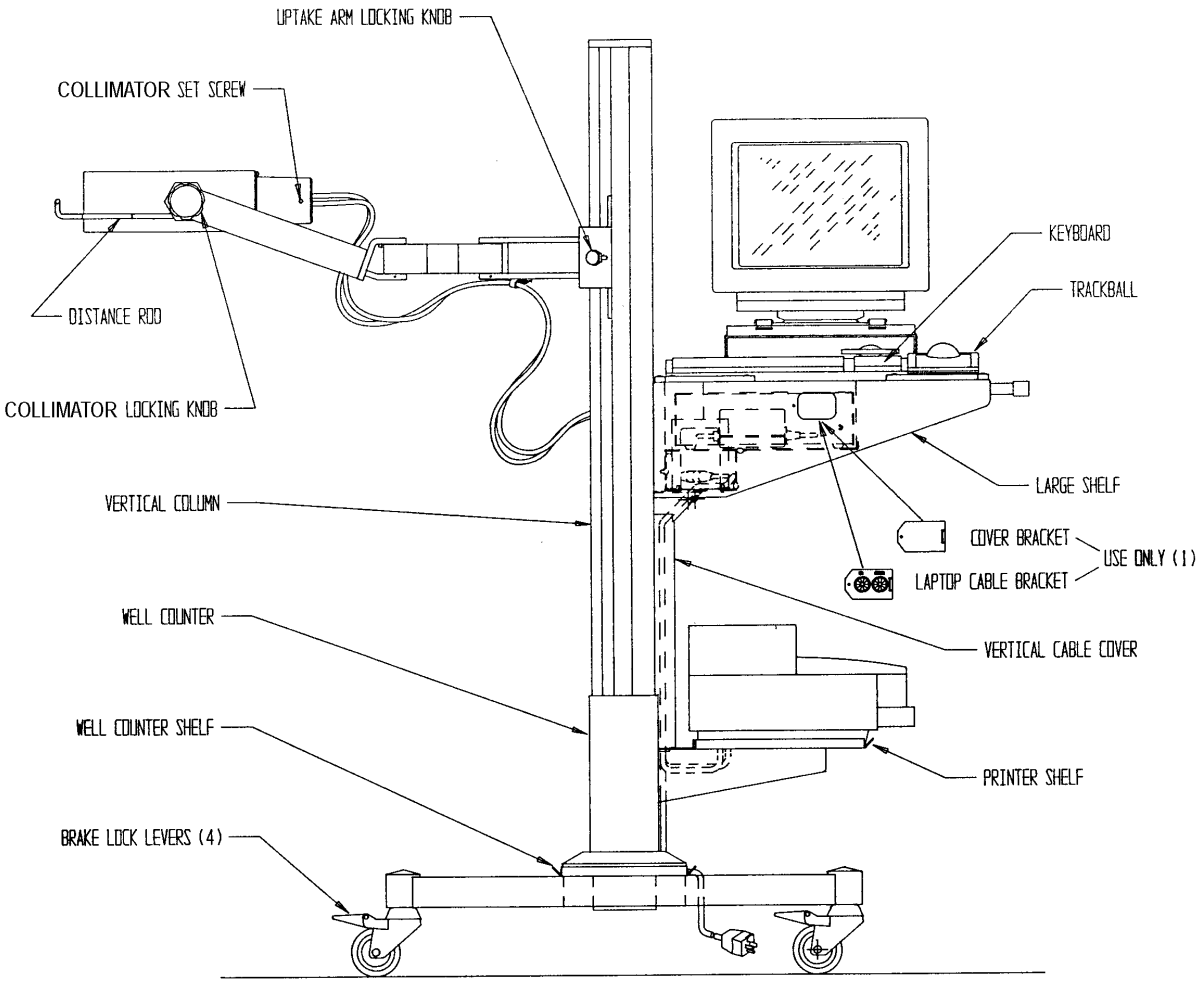


Figure 2-1. The MCA Uptake Stand.

10. Using a small Phillips screwdriver, replace the well support bracket removed in step #8. Ensure that the bracket is positioned over the edge of the well counter base before tightening the two screws that hold it in position. Ensure that both well support brackets are firmly in place.

11. Connect the two well counter cables to the well counter fittings. The larger connector (MHV) should be connected to the high voltage fitting on the well. The smaller connector (BNC) connects to the well signal fitting. Allow the ends of both cables to lie off to the side.

12. On the underside of the large shelf, directly below the MCA shelf, is a power strip. If your unit has a cover over the plug sockets (some units do not), use a Phillips screwdriver to remove the three screws that hold the cover in place. Place the cover aside, retaining the screws.

13. Take the two well counter cables and route them under the printer shelf, up through the printer shelf vertical cover cable hole, through the large shelf vertical cover cable hole and, finally, through the MCA shelf cable hole. Pull the cables snug and allow them to hang out from the front of the MCA shelf.

14. Open the printer box and remove the small box containing the printer power pack. Place the power pack onto the MCA shelf directly above the power strip, or onto the shelf with the powerstrip.

    NOTE: If your stand is pre-wired, skip to step 17.

15. Route the 3-prong power plug from the printer power pack down through one of the MCA shelf cable holes and plug it into the power strip. Now take the long power pack cable with the rectangular end, route it along the back of the MCA shelf and down through the left side MCA shelf cable hole. Continue to route this cable down through the large shelf vertical cover cable hole, down through the printer shelf vertical cover cable hole and, finally, back up through the printer shelf cable hole. Allow eight to ten inches of the cable to protrude through the printer shelf cable hole.

16. Locate the printer cable. Run the strip end of this cable through the large shelf side cable hole, down through the large shelf vertical cover cable hole, down through the printer shelf vertical cover cable hole, and finally, back up through the printer shelf cable hole. Allow eight to ten inches of the cable to protrude through the printer shelf cable hole.

17. Reinstall the vertical cable cover using a Phillips screwdriver and the three screws removed in step 6. Ensure that cables are tucked neatly inside the cover.

18. Remove the printer from the printer box and place it on the printer shelf so that the front faces the same direction as the large shelf push bar. Connect the printer power pack cable and the printer signal cable to the appropriate ports on the back of the printer. To make these connections, turn the printer to expose the connection ports.

19. Open the cover on the printer and remove the tape that holds the print carriage from moving. Open up the print ink cartridge packs and slide them into the print carriage on the printer. The cartridge should slide in, then snap back into position. Place a stack of paper in the paper tray.

20. Loosen the collimator locking knob and rotate the collimator into a vertical position with the distance rod facing down. Tighten the locking knob.

21. If you have not already done so, use an adjustable wrench to remove the RED shipping bolts located near the vertical lock knob. (These bolts keep the arm from moving during shipment.)

22. If necessary, adjust the uptake arm height. To do this, loosen the vertical column locking knob and slide the counter-balanced arm to the desired position. Tighten the locking knob to secure the uptake arm at the desired height.

23. Near the top of the collimator, locate the set screw. Use the supplied 1/32" Allen wrench to loosen the screw in a counterclockwise direction until it retreats enough to allow passage of the tube assembly into the collimator.

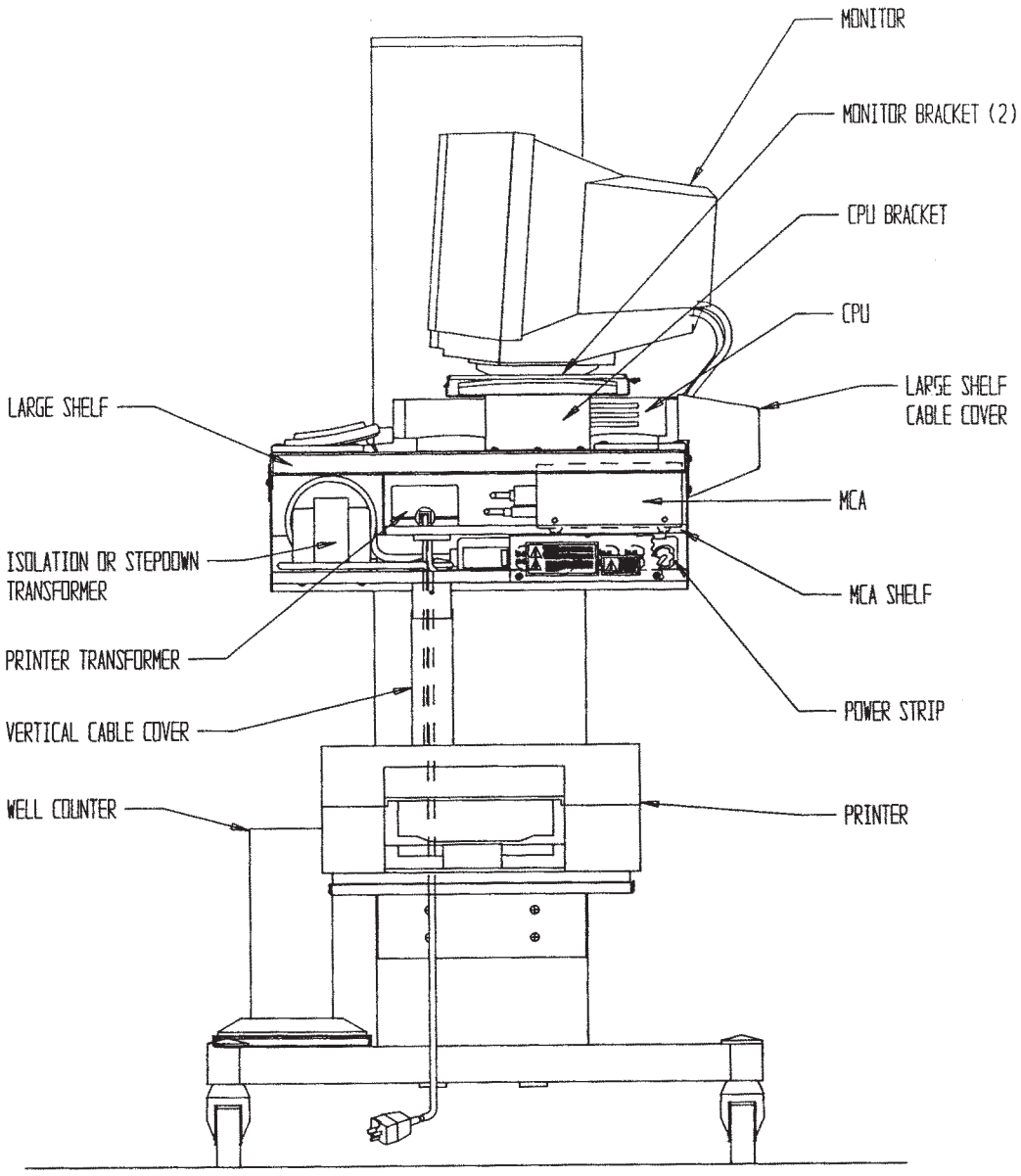


Figure 2-2. The MCA Uptake Stand. (side view).

24. Remove the tube assembly and base from its packaging. Notice that a grounding strap is wrapped around the base and tube assembly. This is necessary to properly ground the detector shroud to the base and stabilize the count rate. Remove the red protective cap from the detector and carefully insert the detector and base assembly into the cone shaped collar. Slide the detector downward until the entire assembly is inserted. At this point, the detector cables should be flush with the top of the collimator. Tighten the set screw to secure the detector in place.

    NOTE: Do not force the assembly into position as it is possible to dent the shroud and damage the detector. If the assembly will not slide easily into place, check to make sure the set screw has been sufficiently loosened and that the red cap has been removed.

25. Route the detector cables between the collimator and the uptake arm collimator yoke. Loosen the collimator tilt locking knob and tilt the collimator so that the detector cables are in the furthest position possible from the uptake stand vertical column (be sure to extend the collimator arm fully).

26. Insert the larger (MHV) detector cable connector through the large shelf back cable hole (alongside the vertical column). You can now push the smaller (BNC) detector cable connector through the same hole. Pull both cables out through the front of the MCA shelf and allow them to hang free.

27. Using a Phillips screwdriver, remove the wire wrap from the underside of the collimator arm. Place the wire wrap around both detector cables and reinstall to the collimator arm. Before securing the wire wrap screw, set the cables so that there is a little slack leading to the detector.

28. Remove the CPU from its packaging and place it on top of the large shelf. Make sure it faces the front of the stand where the operator will be working.

29. Slide the CPU toward the back of the large shelf. Place the keyboard and trackball mouse on the shelf in front of the CPU. The keyboard should be to the left of the trackball.

30. Run the free end of the keyboard cable along the side of the CPU and plug it into the keyboard port at the back of the CPU.

31. To install the trackball, attach one end of the trackball cable to rear of the trackball. Run the opposite end of the cable inside the CPU hold-down and plug it into mouse port on the rear of the CPU.

    NOTE: If you skipped step 4, skip step 32.

32. Take the CPU bracket that was removed in step #4 and position it over the CPU. The bracket lip with the slotted holes should face towards the front of the CPU. With a Phillips screwdriver, reinstall the six screws that secure the bracket to the large shelf. The keyboard cable should be on the inside of the bracket so it is under the CPU.

33. Remove the monitor from its packaging and place it on top of the CPU bracket so that the monitor's base is centered on the bracket.

34. Connect the power and signal cables, labeled for the monitor, to the monitor.

35. Install the monitor hold-down bracket using the bracket bolts and wing nuts.

36. If your system has been pre-wired, plug the power pack cable into the monitor. If your system has not been pre-wired, plug the monitor power pack into the power strip. Run the other end of the power pack cable up the right side hole and out the side of the stand. Now plug it into the monitor.

37. Connect the power cord, printer cable, track ball, keyboard and MCA wires to the CPU.

38. Locate the printer cable that now protrudes from the large shelf side cable hole and plug it into the CPU printer port.

39. Unpack the speakers and place them on the large shelf.

40. Connect the speaker phone jack to the CPU.

41. Connect the speaker power cable to the speakers.

42. Unpack the MCA. Connect the nine-pin signal cable, labeled MCA, to the rear of the MCA.

43. While holding the MCA box in front of, or just below, the MCA shelf, use a straight screwdriver to connect the 9-pin connector to the open port on the back of the MCA.

44. Connect the two probe cables, which now extrude from the front of the MCA shelf, to the appropriate fittings on the back of the MCA. The larger connector (MHV) is for high voltage, the smaller (BNC) connector is for signal.

45. If you have a well counter, connect the larger (MHV) well cable connector to the well high voltage fitting and the smaller (BNC) connector to the well signal port on the back of the MCA.

46. Plug the female end of the power cord into the back of the MCA.

47. Place the MCA box on the MCA shelf so that the front of the MCA faces the side of the shelf with the power ON/OFF switch accessible to your left so that it can be easily turned ON and OFF if required.

48. Make sure that there is paper in the printer tray. If not, add a stack of paper.

49. Plug the main power cable for the uptake stand into a hospital grade wall outlet. Turn the power strip ON and make sure that all the units power up as indicated by their LEDs. If any component is not ON at this point, try flipping the Power ON switch for that component and check that the plugs are inserted properly into both the power strip and into the component.

50. If all components are ON, use a Phillips screwdriver to install the large shelf side cable cover (the screws were removed in step #3,) making sure that the cables which protrude from the large shelf side cable hole are neatly gathered and covered by the cover.

51. With a Phillips screwdriver, reinstall the power strip cover if removed in step #12.

SYSTEM SHUT-DOWN

The Atomlab 950 system is now fully set up and ready for operation. Before it can be moved, however, it must be shut down using the following procedure.

1. At the Windows Desktop screen, which should now be displayed, move the trackball pointer over the “Atomlab950” icon and double-click the mouse. The About Atomlab950 screen should now be displayed. A calibration status box is located on the right side of this screen.

2. Look below the version number of the Atomlab software (under the Biodex Address on the left side of the screen) and check the detector status. If the cables are connected properly at this point, there will be a message reading "Connected To MCA."
   NOTE: If the message reads "Device Not Found," reconnect the cables leading to the MCA and check all other connections. If the system will not connect to the MCA, click on <No> and then click on <Yes> to advance to Simulation mode. You can then exit Simulation mode by clicking on <File> at the top of the screen, selecting <System Setup>, and then clicking on <Simulation Mode> to remove the check mark. See "System Software Set Up."

3. If the detector status is okay, click on <OK> to advance to the MCA Operation screen.

4. Move the pointer over the <X> at the top right corner of the screen and click the left trackball button to exit. The Windows Desktop should now be displayed.

5. Select <Start>. Now click on <Shut Down> and then <OK>. The system will now take several seconds to shut down the computer. When finished, a message will appear on the screen noting that it is safe to turn the system OFF. Turn the power strip off at this time. You can now unplug the system and move it to the location where it will be used.

   NOTE: The push handle can be used as a wire wrap to hold the uptake stand power cord during transport.

GENERAL CLEANING INSTRUCTIONS

As required, wipe down the exterior of the unit using a soft rag slightly dampened with alcohol.

POWER-UP AND SELF-TEST

(See Figures 2-3 and 2-4.)

At this point, your Atomlab 950 Medical Spectrometer should be fully ready for operation. It is recommended that the system be turned ON at least one hour before use or, if possible, left on at all times. This will provide optimum performance and will not effect the longevity of any part or component except the monitor, which should be turned OFF if the Atomlab 950 will not be used for a prolonged period of time.

To Power-Up And Run The Self-Test

Turn on all components, including the printer. The system may immediately advance to the Atomlab 950 program. If not, double-click on the <Atomlab950> icon from the system desktop. Once the Atomlab 950 program is activated, the system immediately performs a self-test. The About Atomlab 950 screen is then displayed.

NOTE: If the system is in Simulation Mode, see System Setup later in this manual to return to normal operating mode.

The Self-Test includes:

- MCA firmware and hardware checks
- DAC value verification
- Display of software/firmware revisions

NOTE: To view a video clip about the Biodex Company, you can at this point click on <About Biodex>.

Once the self-test is complete, the system highlights <OK>. Click on <OK> to automatically advance to the MCA Operation screen. The system is now ready for use.

COMPUTER PRELIMINARIES

Windows Format

The Atomlab 950 PC is a personal computer (PC) based system. All menus and screens function in standard windows fashion. Each screen prompts the user, either through screen prompts or icons, as to all available options. As you begin to explore the Atomlab 950 menus, you'll quickly learn that some options are available from every screen, others are offered only on selected screens and some are specific only to the operation being performed.

Using the Mouse

While numeric "data" is entered into the system by simply typing on the keyboard, options, menus and pages are selected via the trackball mouse. The trackball is simple to use, it responds instantly to all movement by positioning the screen pointer appropriately. To select any option on the screen, simply use the trackball to locate the cursor over the desired icon and click the left trackball button. An hour glass icon appears over the selected option icon, indicating that the system is advancing to the selected option. After a second or two, the new menu, screen or page appears.

To see how the mouse works, select the <Calibration Tab> in the middle of the Operation screen. The Daily Calibration page should appear if it is not already displayed. Now, select the <Manual Tab> to access the Manual Counting screen.

Select the <Calibration Tab> once again to return to the daily calibration page.

SYSTEM-WIDE ICONS

(See Figure 2-5.)

The Primary Tool Bar

The tool bar along the left side of the screen allows users to quickly and easily access the primary modes of operation and screens as follows. Each option is described below in descending order from the top of the tool bar.

- Patient Definition: This screen allows patients to be added, removed, edited or saved.
- MCA Operation: Click on this icon to return to the MCA operation screen or Main Menu of the Atomlab program.
- Report Generation: Click on this icon to access the various different printout options associated with all the modes on the system.
- Spectrum Analysis: After most counting functions click on this icon to view a full page display showing the Spectrum Analysis. You can then adjust ROIs, add ROIs and move a cursor to see the energy and counts associated with different energies.
- Procedure Window. Click on this icon to define the different procedures that you want to use. An example would be to have different methods of the thyroid uptake stored in memory to be used for different types of uptake studies.
- Isotope Editing: At this page you can bring up the list of factory set isotopes or enter any new isotopes that you desire. This mode will also allow the efficiency setting for the detectors for specific isotopes used for Bioassay and Wipe.
- Help: This screen will give certain information about using the system.

Screen Tool Bar

The screen tool bar, located at the top of most major screens, features several buttons that standard conventions in the system and appear on a variety of pages.

Click on <Isotope Editing> in the primary tool bar on the left side of the screen to bring up the Isotope Editing page. On this page, you can view the screen tool bar and follow along with the descriptions below.

- Open: Click on this button to access a list of the items associated with the current function. For example, if you are dealing with isotopes, it brings up the isotope list.

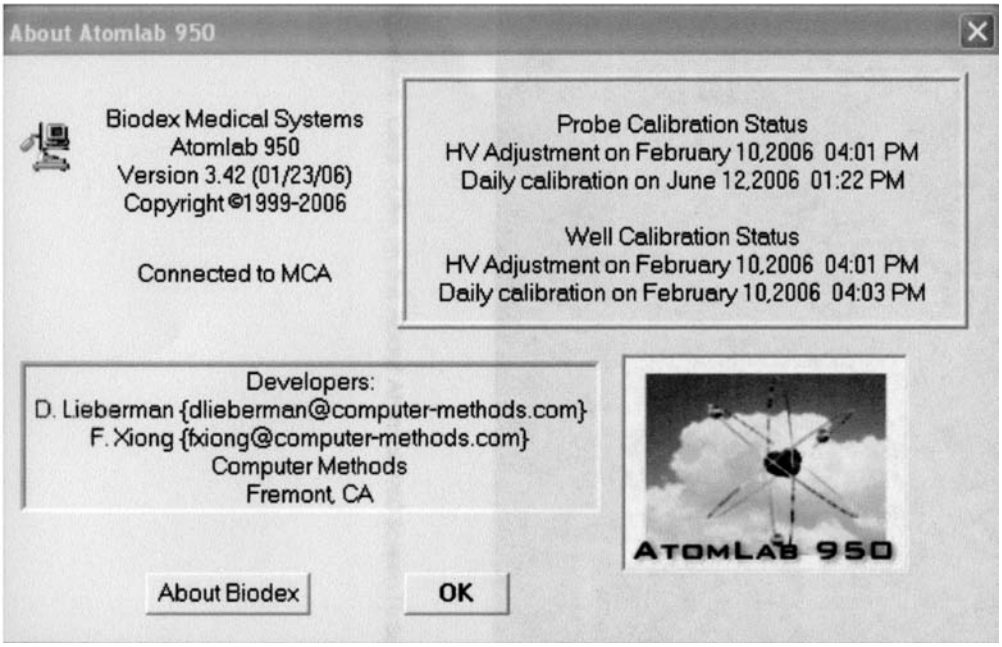


Figure 2-3. Click <OK> on the About Atomlab 950 Screen to Begin the Self-Test.

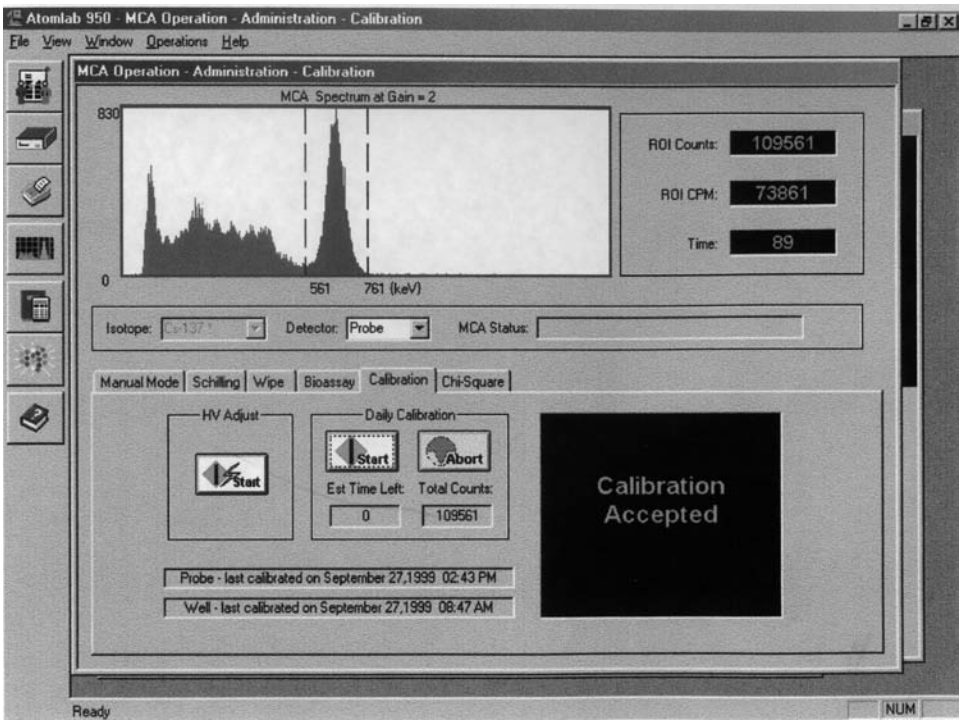


Figure 2-4. The Atomlab 950 PC Operation Screen is displayed at completion of the self-test. The system is now ready for use.

- Add: This button allows you to add an item to the current operation. For example, on the isotope page, you can add an isotope. On the patient page, you can add patients.
- Edit: This button allows you to go in and edit the item that you are displaying.
- Save: Use this option to save any changes or new information that you have entered on the current page.
- Stop/Cancel button will cancel whatever work you were just doing without saving any changes.
- Delete: Use this option to delete information that you have entered. For example, if you entered a patient and are now finished with that patient, you could delete the patient from the system memory.
- Efficiency: Use this button to enter efficiencies for each isotope associated with wipe and bioassay.
- Close: Select this button to close any current window.

Click on <Close> to return now to the Operation screen.

The Menu Bar
The Menu Bar very top of the desktop screen offers standard Windows functions including File, Record, View, Window and Help. The system setup and print-setup options are both accessed by selecting <File> from this menu bar.

- File: Under the File screen, the printer set up button allows you to set up the printer that you are using. The Atomlab 950 uses either DeskJet 694C, 845 or 810C software. The version used is dependent on the Hewlett Packard printer. We recommend using the 694C printer driver. If a different printer is being used, follow the instructions for setting up under Windows. The Database Manager option allows the user to copy or move data. The System Setup button allows the user to set site information.
- View: The View option allows you to view in different modes.
- Window: Allows cascading, horizontal or vertical placement of windows.
- Operations: Allows access to different operating modes.
- Help: Provides help on specific system topics.

The computer operation is a standard Windows format and the Windows format should be used for setting date and time.

SYSTEM SOFTWARE SET UP

(See Figure 2-6.)

The System Setup option allows the user to enter site information including the facility name, address and phone number. It also allows editing of the physician and technologist database, and allows the system to be set for Simulation or Active mode.

To access system setup, click on <File> in the menu bar, then click on <System Setup>. At this screen, a check in the box preceding any option means that the option is active. To activate or deactivate any option, click the mouse on the appropriate option box. Setup options are described below.

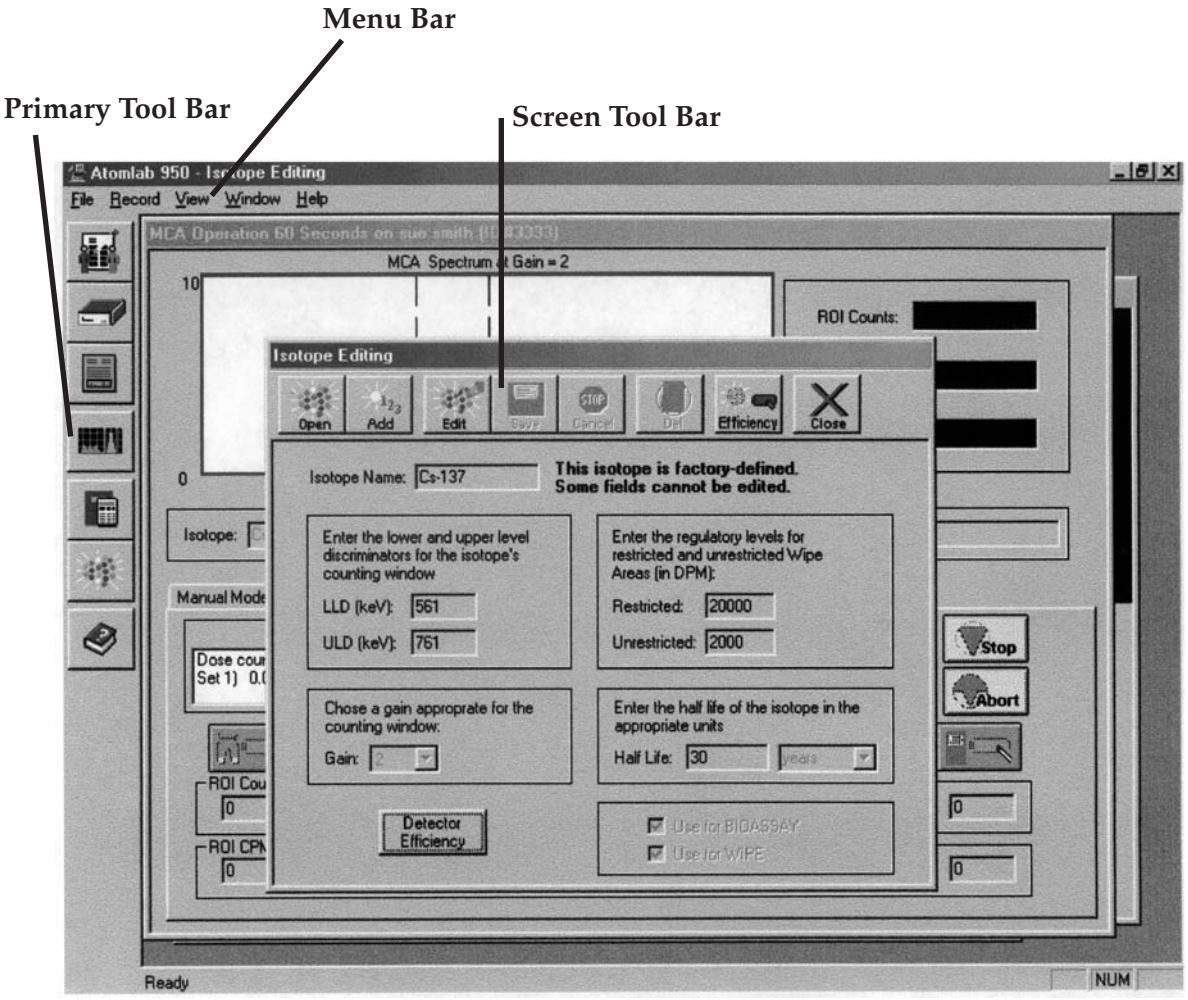


Figure 2-5 The Isotope Editing Screen.

MCA Interface

- Simulation Mode: In Simulation mode, the Atomlab 950 will provide mock measuring without the need for actual activity. This mode allows the user to explore the various screens and modes of the system.

NOTE: EXITING SIMULATION MODE
When the Atomlab 950 System is turned ON and the MCA box is OFF, the computer prompts you to select Simulation mode if desired. If you select Simulation mode, the system returns to the desktop. You can then click on <Start>, followed by <Programs>, <Biodex Medical Systems>, and <Atomlab 950 Simulation> to enter Simulation mode. To exit Simulation mode, click on the <X> in the upper right corner of the screen to return to the desktop. You can then turn the MCA box ON and double-click on the Atomlab 950 desktop icon to access the Atomlab 950 Active mode.

- Port: The port listed is for the MCA box connection. The standard configuration has the MCA box connected to COM 2. The small arrow in the box allows the system to function as a standard pull-down menu.

- Probe or Well: If your system has only one detector, there should be a check mark next to the detector only. This will make the detector your only choice on the menu. If you add a detector at a later time, you will need to access system setup and put a check next to the appropriate detector to make it available for use.

I-131 MIRD "S" Value

This is preset for 0.022 rads per microcurie hours. Enter any desired change and click on <Apply> The changes will cause you to restart the system before they can be applied. If you don't want to make any changes, click on the <Cancel>.

Thyroid Uptake Report

Use the arrow in the box to choose between Efficiency Half-Life and Biological Half-Life.

Site Information

Enter here your facility name and address. The facility name entered here will appear on all printed reports.

Preferences

Check any option here to activate.

- Numerical Data: If checked, allows the operator to change the time and data of administration as well as change the count before it is saved in a mode. For example: If you count background and uptake before you save, you can go in and modify this value.

- Display Absorb Dose In GY Units: Activate this option to display the dose in GY units in the special decay function program.

- Show Calculated Value For APOT (Analyzed Pulses Over Total Pulses.) This is a diagnostic tool that will show as you count. Normal operation for users would have this inactive.

- Number Of Significant Digits: The system is preset for 4. Enter the desired number to change.

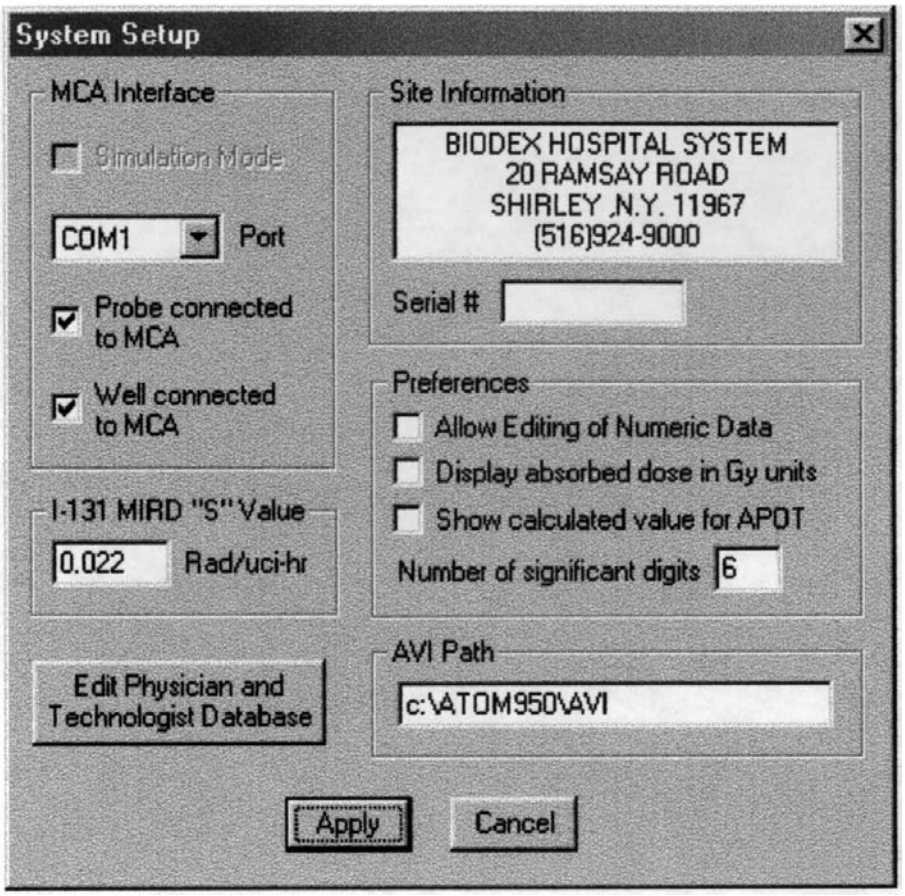


Figure 2-6. The System Setup Screen.

Edit Physician and Technologist Database

(See Figure 2-7.)

To add a new physician or technologist to the database:

1. Click <Edit Physician and Technologist> to access the Edit Physician and Technologist screen.
2. Click <Physician> or <Technologist> to highlight the desired database. The physician or technologist list will be displayed on the right of the screen.
3. Key in the physician or technologist last name, first name and ID number. Use the mouse or <Tab> keys to move from field to field.
4. Click <Save> to save the new entry to the database.
5. Click <Return to System Setup> to return to the System Setup screen.

To edit a physician or technologist:

1. Click <Edit Physician and Technologist> to access the Edit Physician and Technologist screen.
2. Click <Physician> or <Technologist> to highlight the desired database. The physician or technologist list will be displayed on the right of the screen.
3. Click on the physician or technologist to edit, then click <Modify>. The selected entry is now displayed in the edit fields on the left side of the screen.
4. Edit the appropriate fields. Use the mouse or <Tab> keys to move from field to field.
5. Click <Save> to save the new entry to the database.
6. Click <Return to System Setup> to return to the System Setup screen.

To delete a physician or technologist:

1. Click <Edit Physician and Technologist> to access the Edit Physician and Technologist screen.
2. Click <Physician> or <Technologist> to highlight the desired database. The physician or technologist list will be displayed on the right of the screen.
3. Click on the physician or technologist to delete. The selected entry is now highlighted. The system request confirmation that the entry is to be deleted. Click <Yes> to delete.
4. Click <Return to System Setup> to return to the System Setup screen.

AVI Path

This shows the current directory path of the computer files in use. Leave this setting at the default value.

DATABASE MANAGER

(Refer to Figure 2-8.)

The Database Manager portion of the program allows patient information, procedures specifications or isotope information to be saved to a floppy diskette or other information storage format.

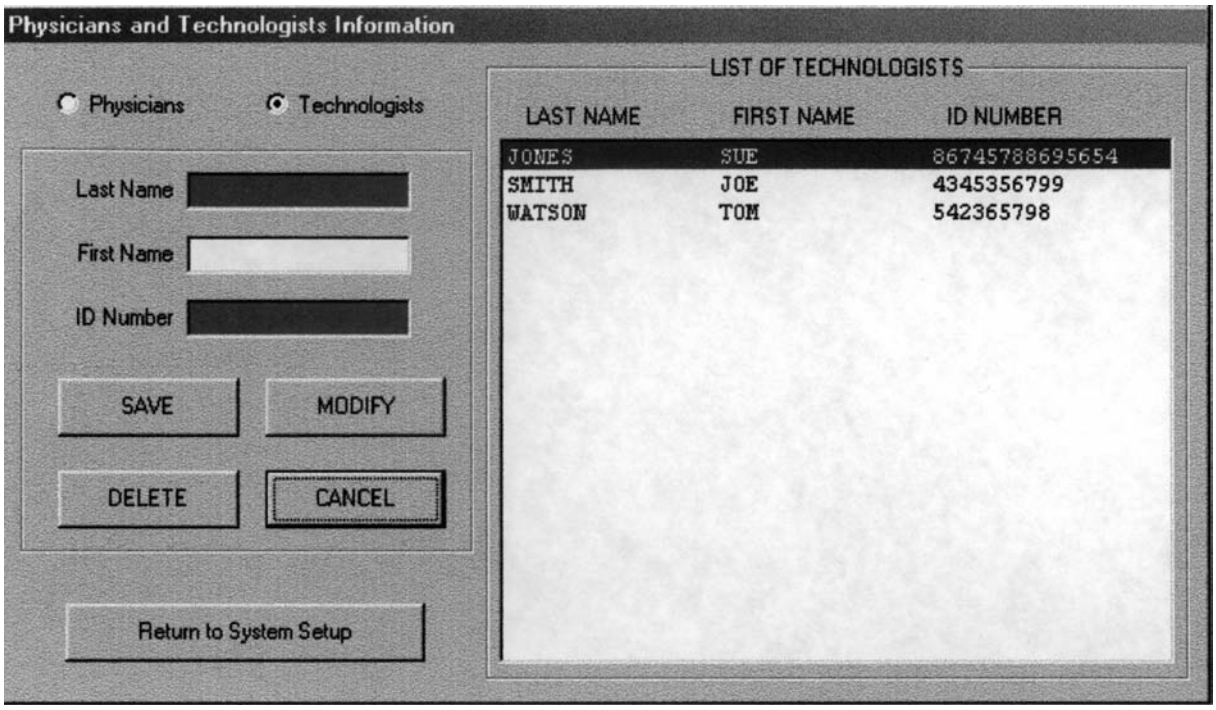


Figure 2-7. The Edit Physicians and Technologists Information Screen.

To Save Patient Specific Data:

1. Click on <Patient Definition> to open the patient definition window.

2. Insert a blank floppy diskette into the floppy drive.

3. Click on <File> in the menu bar, then click <Database Manager> on the drop-down list. The Database Manager screen is now displayed. The left side of the screen displays the current information while the right side shows where the data will be stored or transferred.

4. To save a specific patient's data, click on that patient in the left hand column. The arrow at the top of the page will then point to the right, which is labeled "Backup."

   NOTE: Drive A: should be shown as the back-up destination. If drive A: is not displayed as the back-up destination, use the Back-up drop-down menu to select Drive A:. If Drive A: is not displayed as an option on the Back-up drop- down menu, click on the "..." box below "Backup" at the upper right of the screen. Choose 3-1/2" Floppy (A) from the drop-down menu to select drive A, then click on <Open>. The system should return to the Back-up screen with drive A: now selected.

6. Click on the <Copy> button in the bottom center of the screen to duplicate the source file onto the floppy.

   NOTE: To copy all of the patients in the database, you can highlight all the patients by clicking on the first one and then sliding the pointer down to cover all the patients. Click on <Copy> and all patient data for all patients will be transferred to the floppy.

To Transfer or Restore Data From A Floppy To The Hard Drive:

1. Click on <Patient Definition> to open the patient definition window.

2. Click on <File> in the menu bar, then click <Database Manager> on the drop-down list. The Database Manager screen is now displayed. The left side of the screen displays the current information while the right side shows where the data will be stored or transferred.

3. Highlight the right hand column upper window and type in A:\. Highlight the specific patient or patient data that you wish to transfer to the hard drive. When you click on the right hand column, the arrow at the right will show the direction the data will move. When this is correct, press the <Copy> at the bottom of the screen.

   NOTE: The <Move> function works like the copy function. It removes it from the original database and puts it into the backup database.

To Remove Data:

1. To remove data in the bottom hand box, click on <Remove>.

2. Highlight the data or item in the right hand box that you wish to remove.

3. Click on <Remove> and a pop-up window will ask if you really want to remove this data. If you do, click <Yes> and the system will proceed to remove the information. When you are done, click on the <Exit> button in the center and this will take you back to the regular Atomlab program.

   NOTE: If there is already data in a patient file, you must delete that patient in the backup before you can transfer from the original data.

   NOTE: To back-up "procedures" you must save the Isotope information to the backup before transferring the procedures.

Directly underneath the <Page Index> icon is the <Page Flip> icon. This icon looks like a folded page corner. Clicking the trackball on this icon advances you forward, one page at a time, through the currently selected operation.

The <Page Index>, <Page Flip>, <Main Menu> and <Exit> icons are available from every page and menu throughout the program. Additional icons, such as the <Preferences> icon which allows the user to set such functions as automatic or manual count time, are offered where appropriate.

NOTE: Any prompt or icon that is highlighted with a bold border can be activated by pressing the return key, or you can move the cursor over the prompt and click the mouse. At some points in the program, the next most logical and useful selection will appear in bold, although this does not hold for every page.

Setting Date and Time

To ensure that the correct date and time appear on printed reports it is necessary to set the system clock and calendar as follows.

1. From any Atomlab 950 screen, press and hold down the <Apple> key located directly to the left of the <Space Bar>, followed by the <Back Tic> key located to the left of the <#1> key on the keyboard. The screen border will disappear and the Macintosh Apple icon will appear at the top left side of the screen.

2. Use the mouse to position the cursor over the Apple icon and hold down the mouse button to reveal the "About the A950" window. Continue to hold down the mouse button while guiding the cursor to the "Control Panels" prompt. With the Control Panels prompt highlighted, move the curser to the right over Date & Time and let go of the Track Ball button..

3. The Date and Time window displayed. The current computer date and time will now be displayed.

4. To change the Time setting, use the mouse to position the cursor on hour, minutes, seconds, A.M. or P.M., and click the mouse once. The selected Time segment will now be highlighted.

5. With the desired Time segment highlighted, use the mouse to click on either the <Up> or <Down> arrows in the Date and Time window to increase or decrease the time setting appropriately. The same procedure is used to change hours, minutes and seconds. To change the date, follow the same procedure, highlighting the segment of the date to be changed, i.e., day, month or year.

6. If you wish to change the Date or Time format, i.e., select between a 12 and 24-hour clock, etc., click the mouse on the "Formats" prompt and refer to the Macintosh User's Guide for more detailed instruction.

7. Once the Date and Time are set, click the mouse on the Date and Time close icon in the upper left corner of the Date and Time window. Now click the mouse on the close icon for the Control Panels window to return to the Atomlab 950 screen from which you began.

8. To remove the Apple icon and restore the background border to the Atomlab 950 screen, click the mouse on the approximate center of the screen. Now press and hold down the <Apple> key, followed by the <Back Tic> key.

General Cleaning Instructions

As required, wipe down the exterior of the unit using a soft rag slightly dampened with alcohol.

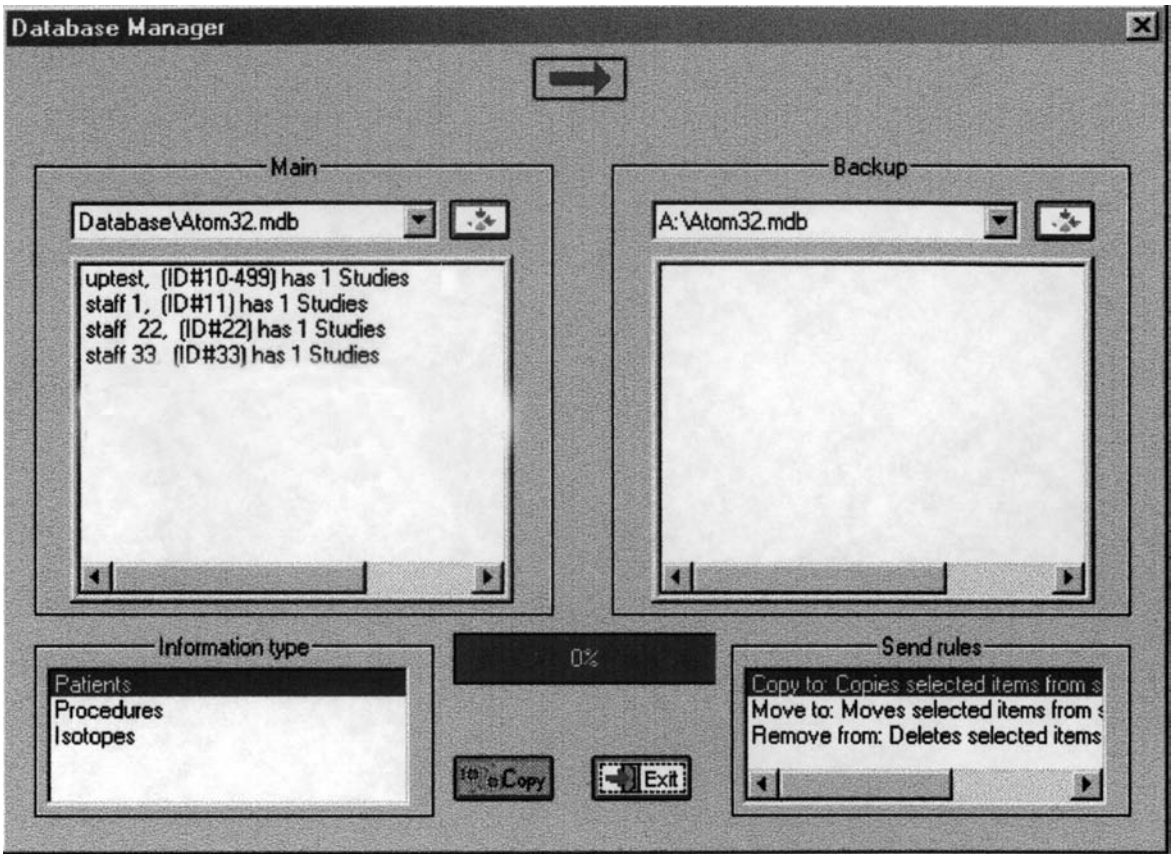


Figure 2-8. The Database Manager Screen.

3. ADMINISTRATION

Before using the Atomlab 950 PC for counting purposes, it is important that you take a few minutes and prepare the system for operation. The following functions are set from the Operation screen and control the system throughout the different program modes.

NOTE: Before you begin with this chapter, be sure to enter your facility name and address in the Site Information area, as explained in the section on System Setup. This will allow the system to print the facility name on all printouts

- Daily Calibration
- Chi-Square Test
- High Voltage Adjustment
- Isotope Editing
- Isotope Efficiencies
- Detector Efficiency
- Analysis (also available for each operation)
- MCA Operation

Daily Calibration

(See Figure 3-1and 3-2.)

NOTE: The system must be ON for at least one hour before performing a calibration. This will allow time for the unit to warm-up and stabilize.

Calibration Information

A daily system calibration must be performed each day the Atomlab 950 is to be used. Separate calibrations are performed for the probe and well. The system keeps an internal listing of its last calibration date and displays a message that calibration is needed. The user must then either perform a calibration or click on the prompt that a calibration will not be performed. The system will not allow measurement procedures to commence until the calibration prompt has been answered. Standard calibration may be performed from any operating mode.

Calibration is performed automatically from the MCA Calibration screen. This screen advises when the last high voltage and calibration were performed for your detectors. It also checks to ensure that the MCA box and CPU are connected and communicating with each other.

Additionally, the calibration calculates full width half max (FWHM). FWHM is determined by interpolating between two immediate points above and below the 50% value of the spectrum peak on both sides of the peak. The difference between the two interpolated channel numbers are then divided by the channel of the peak itself and multiplied by 100% to arrive at FWHM. The peak is simply the maximum value in the spectrum.

It is not required to calibrate both detectors each day unless you are going to use them. If you do not calibrate the detector when you go to use that detector, you will get a message advising you to calibrate. It is recommended to do your calibrations in the mornings daily so that if you need to use the system, it is ready to go.

If desired, you may perform additional calibrations on the same day whenever you desire by clicking on the <Calibration> mode tab.

While the daily calibration is counting, in the upper right you see the ROI counts incrementing and the CPM incrementing as well. The elapsed time is shown next to the time button. Below the start button is a box listing estimated time left. This gives the remaining time to complete the calibration. The spectrum increments as you count as the packets with the data are downloaded to the computer from the MCA. The <Abort> button is highlighted and is the default button used in this mode at this point. You will

notice a dotted line around <Abort>. This means that by pressing the space bar it will automatically stop and you do not need to move the pointer to that pointer. The <Abort> button stops the system from counting and also will not retain the information that has been counted during this function.

When the system finishes counting in the upper right you will see what looks like a MCA box sending information to the computer pictorially. This means that a final download of information is being sent. After the information is sent, a screen is displayed listing the full width half max (FWHM), the energy in the peak channel. If this is acceptable click on <Accept> in the pop-up window. If you do not want to accept it, press <Cancel>.

Both daily calibration and Chi-Square tests are performed using a 10 µCi Cs-137 button source. Once calibration is underway, the system's unique differential spectrometer automatically measures the peak height and subtracts the base line - which makes zero adjustment obsolete. It does this for 100,000 pulses and then plots a spectrum in internal memory. The peak channel is located and equated to 662 keV, which is the Cs-137 gamma entered. This gives the spectrometer the keV per channel which is used to calibrate all of the other isotope gains. Each clinical isotope has a ROI defined with lower and upper energy limits. These energy limits are then converted to channels in the MCA when a particular isotope is counted. Corrections are made for sodium iodide NaI non-linearity. There is no need to view the spectrum of calibration or any other isotope, although this is available on the display and in hard copy by selecting the spectrum icon.

The multi-channel analyzer in the Atomlab 950 has several fixed precision gains and a regulated high voltage supply. The pulse shapes are digitized and then processed by a high speed digital signal processor. This processing results in a possible 1024 pulse heights which has zero offset. A spectrum results when a histogram of these pulse heights (channels) is plotted. Calibration of the spectrometer is defined as knowing the energy equivalence of each channel. This is accomplished by determining the Cs-137 spectrum and then calculating the ratio of the 662 keV/peak channel. After calibration, the report should always print a peak value very close to 662 keV (some precision round-off may occur), and the change in calibration will be reflected in the keV/channel slope value. The fine gain can be thought of as a floating point numerical gain. The HV adjust will ultimately determine the maximum energy one can measure on the gain selected. It can be calculated by multiplying the keV/channel times 1024.

To Perform a Daily Calibration

1. After the system has been turned ON for at least one hour, select <Calibration> from the Operation screen. The Calibration menu is now displayed on the screen. Select well or probe in the detector window.

2. Position the 10 µCi Cesium-137 source approximately six inches in front of the appropriate detector.

3. Click on <Start> daily calibration.

4. The display will tell you that probe calibration is in progress. If calibration is successful, click on <Accept>. Click on <Ignore> to discard the calibration without saving.

5. After accepting the calibration, you can print a report by clicking on the <Report> icon in the primary tool bar at the left of the screen.

6. In the Report window you can enter the technologist's name and any comments required for these reports. To review the report, click on <Preview>. To print the report, click on <Print>.

7. The printer page will now be displayed. If the correct printer is indicated, you can select multiple copies or, for some reports, the number of the page you want to print.

   NOTE: If you just click <Print> the calibration pages for both the well and probe will be printed. If you only performed the calibration on one detector and only want to print that detector, you must indicate that on the print page. This is done by adjusting the print range from All to Pages (from XX to XX). You can print at anytime the latest calibration screens for each detector.

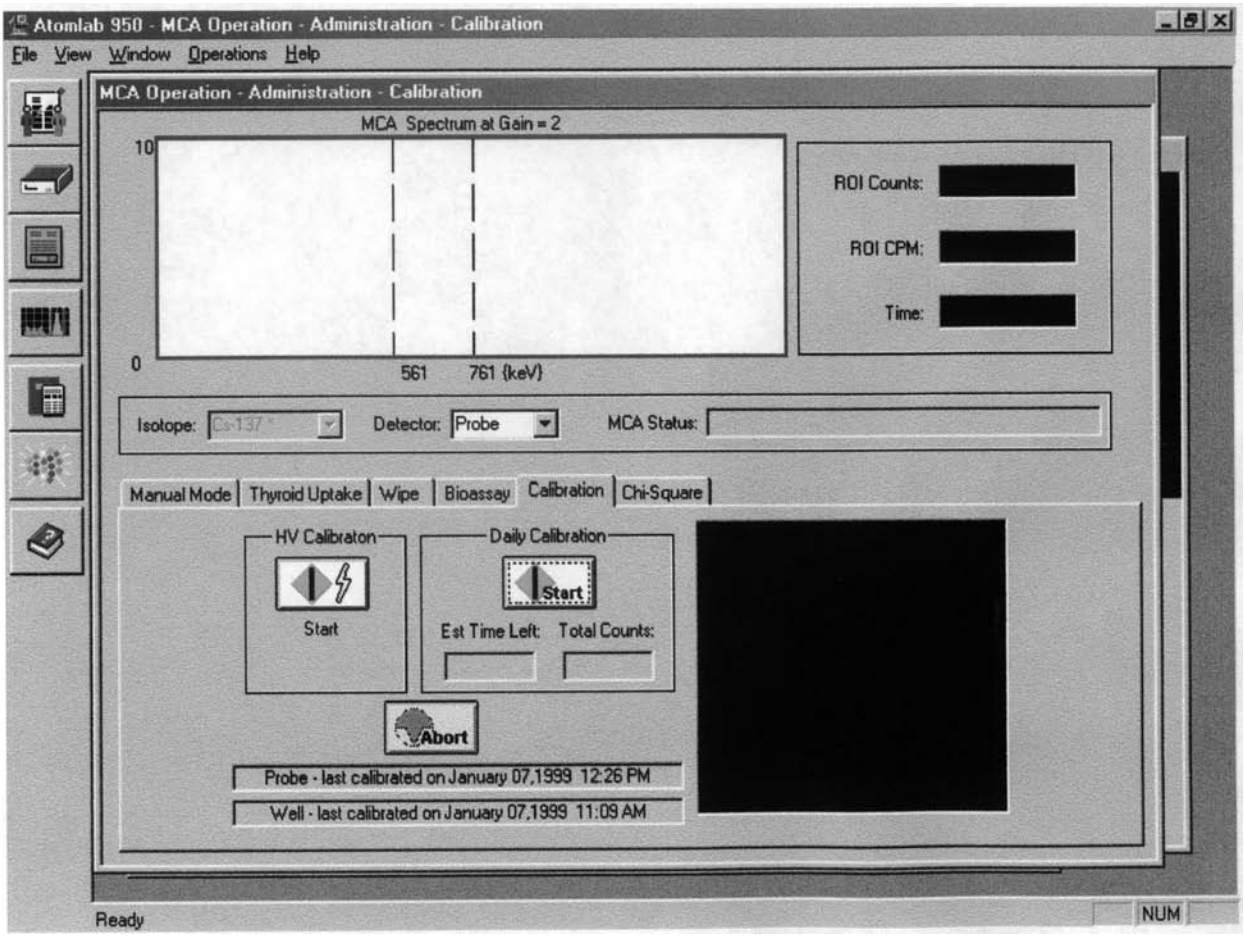
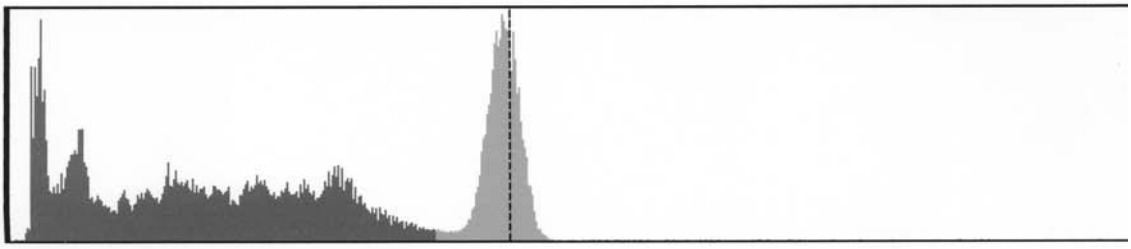


Figure 3-1. The Calibration Screen.

Your Hospital Name
Address
City, State Zip
(000) 000-0000

Calibration Report

Acquired on November 21,2003 06:23 AM



Counting Parameters

Isotope:	Cs-137	Detector:	Probe
Gain:	2	Count Time (sec):	160

Spectrum Statistics

Range (keV):	0 - 1527	Counts Outside Range:	44
Peak Energy (keV):	661		
Peak Counts:	1459	Peak Count Rate (cpm):	547
Total Counts:	309242	Total Count Rate (cpm):	115965

ROI Statistics

Energy Window(keV):	561-761	ROI Counts:	97542
Peak (keV):	661	Peak cpm:	547
Peak Counts:	1459	ROI Rate (cpm):	36578

Technologist:

Comments:

Signature: _____ **Date :**_____

Software version 3.36, Unit Serial # 11111

Figure 3-2. A Calibration Report.

Calibration Screen Description

Multi-channel analyzer display: This display has a scale on the left side showing counts full scale. On the bottom is the scale that shows the ROI.

ROI Counts: To the right of the MCA display is a box showing ROI counts for region of interest counts, ROI cpm and time. The time is the time that the system is counting.

Isotope: The isotope in this box is the one displayed above as the region of interest. This is the isotope for which the system will count.

Detector/Well: To the right of the Isotope is a box showing the active detector or well. To display the available detectors or wells, place the cursor over the small arrow in this box. If you would like to change the detector or well, click on the desired detector or well to select. The new detector will now be displayed in the Detector box.

MCA Status: This box provides notes about what is happening at the current time. It will tell you when counting is in progress or that information is being downloaded from the MCA box to the computer as well as a number of other informational items.

Modes of Operation: Below the MCA Status box are tabs for the different modes of operation. These tabs include Manual Mode, Thyroid Uptake, Wipe, Bioassay, Calibration and Chi-Square.

Mode or Function Specific Counting: Below MCA Status box is Mode or function-specific counting information. Each mode has a <Start> button. Clicking on <Start> immediately begins the counting. The <Abort> button is used to stop counting without storing the data. The <Stop> button stops the MCA from counting but continues to use the information gathered in the program in which you are working.

High Voltage Adjustment should be performed the very first time the system is used, if the system is to be used in a new environment or in the instance where a substantial change has been made, i.e., when using a new tube.

NOTE: If a probe and well are both used the high voltage adjustment must be set independently for each detector. The system must be ON and warmed-up prior to setting the high voltage.

High Voltage Adjustment

(See Figure 3-3 and 3-4.)

To Perform a High Voltage Adjustment

NOTE: When a High Voltage Adjustment is performed on a detector, the previous calibration and Chi-Square for that detector are zeroed. You must perform a new calibration and Chi-Square for a detector following a High Voltage Adjustment. You can do a High Voltage Adjustment for either detector at any time.

1. From the Operation screen, click on <Calibration>. The Calibration screen should now be displayed.

2. Click on <HVAdjustment> to access the High Voltage Adjustment counting screen.

3. Click on the appropriate detector.

4. Click on <Start> to perform the High Voltage.

   NOTE: If you do not want to perform a High Voltage, click on the <Continue> and the system will return to the Calibration page.

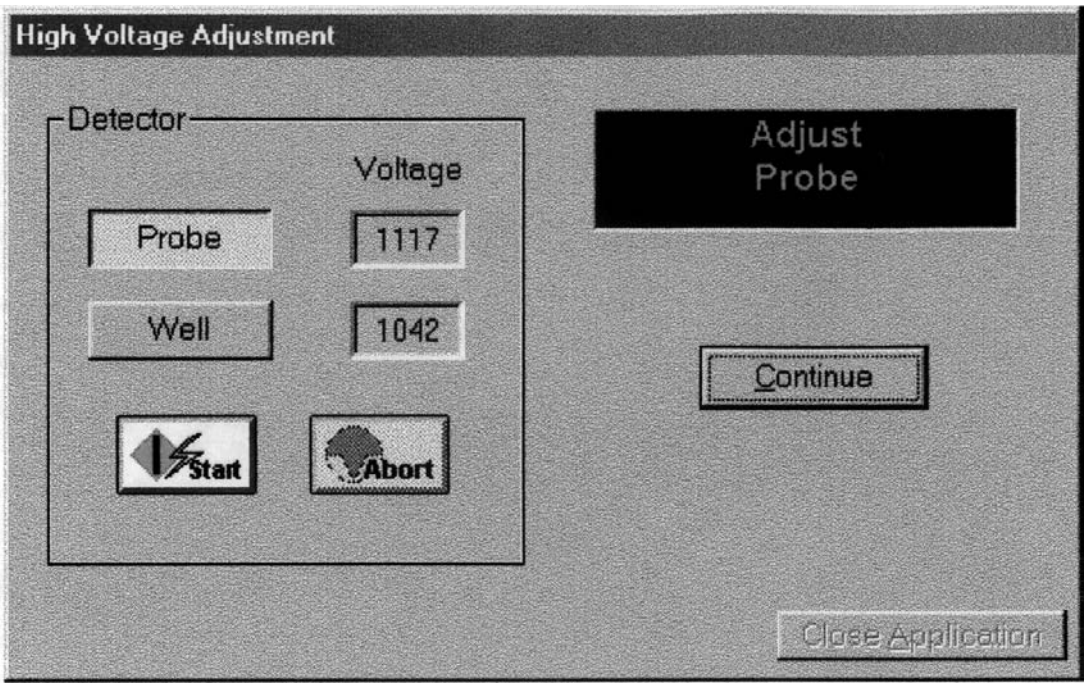


Figure 3-3. The High Voltage-Adjustment Screen.

Your Hospital Name
Address
City, State Zip
(000) 000-0000

High Voltage Report

Printed on Monday, June 07,2004 09:25 AM

Radionuclide

Isotope: Cs-137
Gain: 2

Peak Energy (keV): 661

High Voltage Adjustment

Detector	DAC Value	Voltage Value	Date
Probe	127	998	March 11,2003 12:00 PM
Well	125	994	November 06,2003 12:39

Calibration

Detector	C-Factor	FWHM (%)	Date
Probe	2.660	7.65	March 31,2004 11:18 AM
Well	2.905	6.15	June 07,2004 09:19 AM

Technologist:

Comments:

Signature: _____ **Date :** _____

Software version 3.36, Unit Serial # 999999

Figure 3-4. The High Voltage Report.

5. Once a High Voltage Adjustment is started, it will run until it is completed unless you choose to abort. When it is completed, the system will inform you and then shift to the other detector to allow you to do another high voltage adjustment if desired.

6. Click on <Continue> to return to the Calibration page.

   NOTE: If you have started a high voltage adjustment and wish to stop, click <Abort>. This will stop the count. Click <Continue> to return to the Administration page.

Chi-Square

(See Figures 3-5 and 3-6.)

As is the case with Daily Calibration, Chi-Square is performed using a 10 µCi Cs-137 button source. The Chi-Square Test is independent of the counting time, counting rate, and number of counts performed. For this reason, Chi-Square is a very valuable test for a detector system which is recording truly random events. For example, if systematic failure occurs at low counting rates but passes at high rates, there is an indication of a non-random event occurring which is comparable to the low counting rates. Since time is precise to within 10 microseconds with a crystal controlled clock, 10 second count times should have very little error due to the timer itself.

The number of counts performed is 10, which determines the number of degrees of freedom (9) for the analysis. The lower limit is 4.168, the upper limit is 14.68. These correspond to a 90% probability for passing the lower limit, and 10% probability for passing the upper limit, respectively. In all, one would expect a 20% failure rate frequency for the Chi-Square test. It is not reasonable to always pass or always fail Chi-Square without raising concerns that there may be a systematic problem in the detector or counter.

NOTE: The system stores the information for the latest Chi-Square test performed on a detector. Chi-Square can be performed as frequently as desired, but is generally performed quarterly.

To Perform Chi-Square

1. Click on the <Chi-Square> tab in the center of the Calibration screen. This brings up the Chi-Square screen.

2. Select the detector on which to perform a Chi-Square. The arrow in the detector box will bring up your choice of detectors. Highlight the appropriate detector and proceed.

3. Position the 10 µCi Cesium source in front of the appropriate detector. Click on <Start> and the system will automatically perform a Chi-Square test on the selected detector.

4. The system will display the elapsed time and the pass number that is currently being counted. The pass number is the sample number currently in progress. The system will automatically increment until all 10 passes or samples have been counted. At the completion of the 10th pass the system will calculate Chi-Square and display the value on the screen, along with a passed or failed note. At this point the result is entered into the system memory.

5. You can print out a Chi-Square report by clicking on the <Report> icon in the primary tool bar and then choosing Chi-Square.

6. If desired, enter the technologist and any comments you want printed with the report. To review what is going to be shown, click on <Preview>. To just print, click on <Print>. In print the default is ALL, which will print the latest Chi-Square reports for both well and probe. If you only performed one Chi-Square at this time, highlight pages from 1 to 1 for probe, or from 2 to 2 for well only.

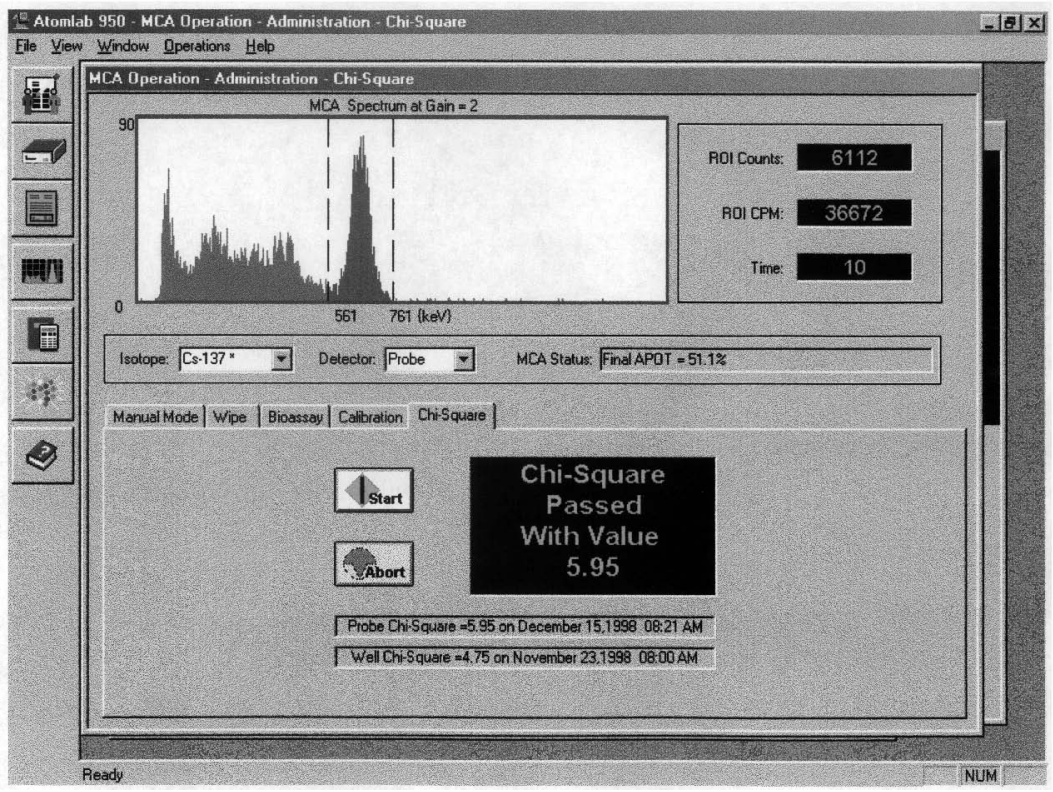


Figure 3-5. The Chi-Square Screen

Your Hospital Name
Address
City, State Zip
(000) 000-0000

Chi-Square Report

Tested on February 02,2004 10:18 AM

Chi Square Test

# of Samples:	Count:
1	53530
2	53145
3	53122
4	53299
5	53390
6	53670
7	52951
8	53458
9	53171
10	53192

Chi Square Table (9 DOF)

Probability:	Chi-Square:	
0.99	2.09	
0.95	3.33	
0.90	**4.17**	< Lower Limit
0.50	8.34	
0.10	**14.68**	< Upper Limit
0.05	16.92	
0.01	21.67	

Count Time per Sample: 10 Seconds

Detector: Well

Results: Passed

Value: 8.03

Technologist: James Smith

Comments:

Physician: _____ **Date:** _____

Software version 3.36, Unit Serial # 999999

Figure 3-6. The Chi-Square Report.

7. Click <OK> and the report will automatically print. The system returns to the Report Generation screen from which you can print another report if you like. To close the Report Generation screen, click on the <Close> icon.

A sample Chi-Square counting screen is shown as well as a Chi-Square printed report.

Administration Report

(See Figure 3-7.)

Following daily calibration, Chi-Square, or High Voltage, the user can print an Administration Report showing the High Voltage Value, Calibration Factor full width half max (FWHM), most recent Chi-Square results, the person performing the calibration and comments. This report can be printed anytime.

To Print An Administration Report

1. Click on the <Report> icon in the primary tool bar.

2. Choose <Administration Summary>. You can enter a technologist and comments. If you desire to look at the report before printing, click on <Preview>.

3. Press <Print> to print the report. This brings up the printer screen.

4. Click on <OK> to print.

   NOTE: The High Voltage Report and the Atomlab 950 Administration Report are similar. The Atomlab 950 Administration Report includes Chi-Square results, the High Voltage Report does not include the Chi-Square results.

Isotope Editing

(See Figures 3-8, 3-9.)

This option allows the user to select and view a preset isotope, add a new isotope to the isotope list, edit an existing user-entered isotope, and activate an isotope so that it can be used for Bioassay or Wipe functions.

The Atomlab 950 isotope list comes with 23 preset isotopes. For these factory isotopes, Lower Level Discriminator (LLD), Upper Level Discriminator (ULD), regulatory alarm levels and Gain are factory preset and cannot be changed. For all user entered isotopes, LLD, ULD and Gain can be edited.

While this option is active, the currently selected isotope is always highlighted in the isotope name at the top left of the page.

NOTE: Placing a checkmark in the <Use For> field at the bottom right of the screen allows the selected isotope to be used for Bioassay or Wipe. If you do not check the <Use For> fields the isotope will be unavailable for these functions. Once you have checked the appropriate function(s), add a detector efficiency as described later in this chapter.

To Select a New Isotope

1. Click on the <Isotope> icon in the primary tool bar. The Isotope Editing screen should now be displayed.

2. The Isotope Editing screen displays information about the currently selected isotope. Click on <Close> to keep the currently selected isotope and return to the Main Menu.

Your Hospital Name
Address
City, State Zip
(000) 000-0000

Atomlab 950 Administration Report

Printed on Monday, February 02,2004 01:50 PM

Radionuclide

Isotope: Cs-137
Gain: 2

Peak Energy (keV): 661

High Voltage Adjustment

Detector	DAC Value	Voltage Value	Date
Probe	127	998	March 11,2003 12:00 PM
Well	125	994	November 06,2003 12:39 PM

Calibration

Detector	C-Factor	FWHM (%)	Date
Probe	2.671	6.46	February 02,2004 10:22 AM
Well	2.893	6.13	February 02,2004 10:12 AM

Chi-Square: Results

Detector	Results	Value	Date
Probe	Passed	14.24	February 02,2004 10:29 AM
Well	Passed	8.03	February 02,2004 10:18 AM

Technologist:

Comments:

Signature: _____ **Date :** _____

Software version 3.36, Unit Serial # 999999

Figure 3-7. An Administration Report.

3. To select another isotope from the Isotope Editing screen, click on <Open>. A list of isotopes will be displayed.

4. Highlight the desired isotope from the Isotope List and click <Select>. The new isotope is now displayed in the Isotope Name box. All information on the Isotope Editing screen now reflects the new isotope.

To Add or Modify a New Isotope

Adding an isotope is most easily accomplished by modifying an existing isotope from the Isotope List. (For example, if you want a wider window for Technetium then the factory preset value, modify Technetium on the Isotope List so that it has a new name such as "Technetium Wide." You can then modify the upper and lower level discriminators.)

1. Click on the <Isotope> icon in the primary tool bar. The Isotope Editing screen should now be displayed.

2. Click on <Open>. The Isotope List should now be displayed.

3. Highlight the desired factory isotope to modify from the Isotope List and click <Select>. The new isotope is now displayed in the Isotope Name box. All information on the Isotope Editing screen now reflects the new isotope.

4. Click on <Add>.

5. Enter a custom name for the new isotope and modify the specifications as required.

6. Once all modifications are complete, click <Save> at the top of the isotope menu. If you do not wish to save what you have entered or want to get out of this screen, click <Cancel> to exit without saving.

To Edit An Isotope

With the Isotope Editing Screen displayed, clicking on <Edit> allows you to change information associated with the currently selected isotope. For factory isotopes, you can adjust only detector efficiency or whether to use it for Bioassay or Wipe.

For custom isotopes editing allows for adjustment of area readings, half-life gain, ROI settings, as well as the isotope name.

1. Click on the <Isotope> icon in the primary tool bar. The Isotope Editing screen should now be displayed.

2. Click on <Open>. The Isotope List should now be displayed.

3. Highlight the isotope to edit and click on <Edit>.

4. Make the appropriate changes to the isotope you are editing.

5. Once you have made the edits desired, click <Save> to save the edited isotope.

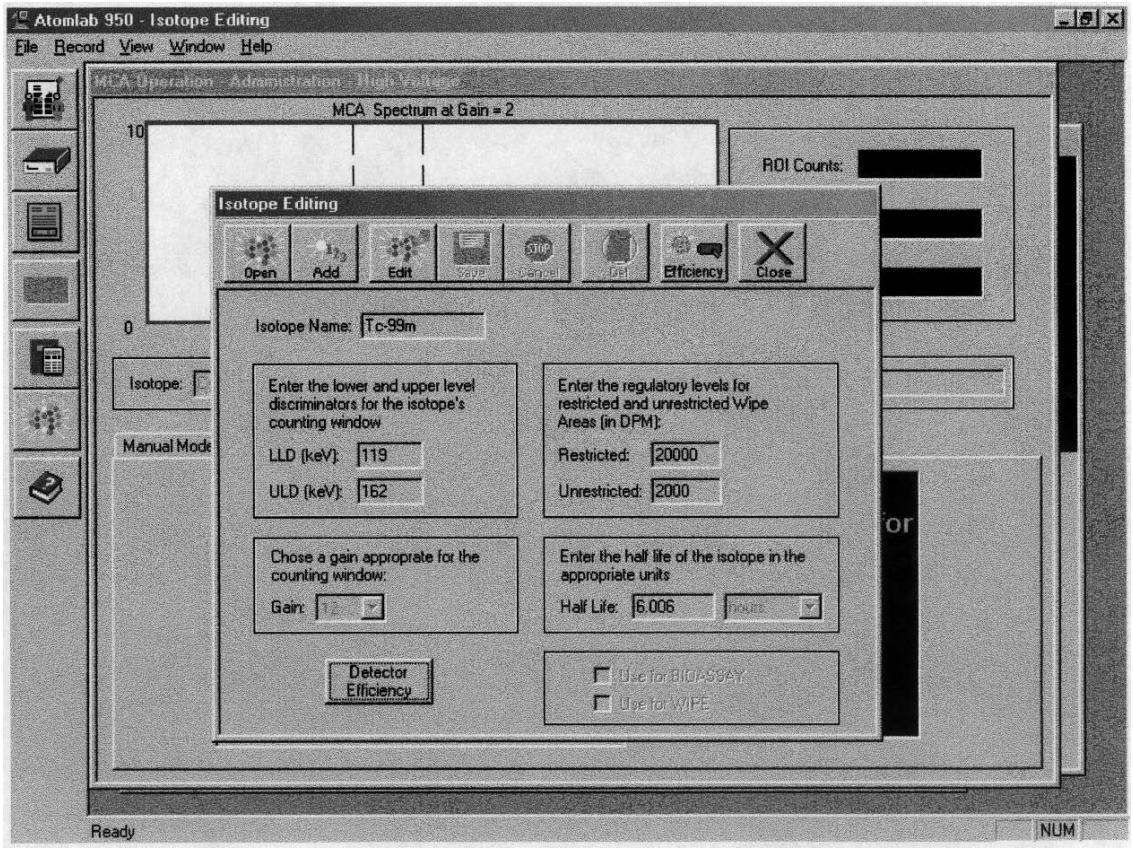


Figure 3-8. The Isotope Editing Screen.

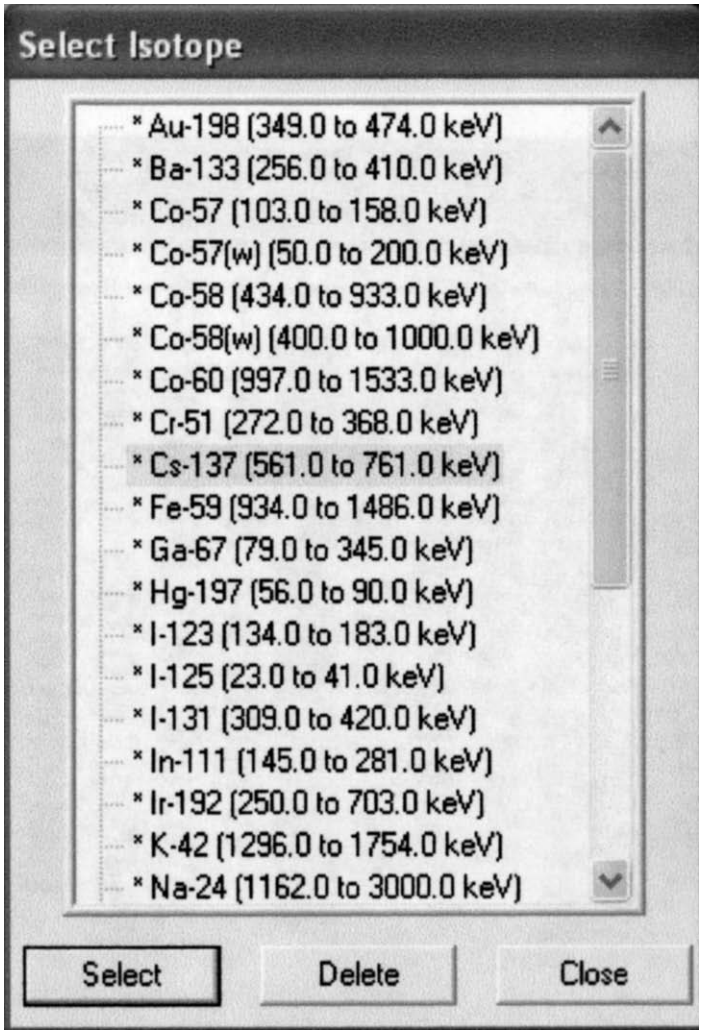


Figure 3-9. The Select Isotope Window.

To Delete an Isotope

Only custom isotopes can be deleted from the Isotope Editing screen. Factory set isotopes cannot be deleted.

1. Click on the <Isotope> icon in the primary tool bar. The Isotope Editing screen should now be displayed.

2 Click on <Open> The Isotope List should now be displayed.

3. Highlight the isotope to delete.

4. Click on <Delete>. The system will ask if you really want to delete the selected isotope. Click <Yes> to delete or <No> to abort. The system will now return to the Isotope Editing screen. If you have deleted a custom isotope it will no longer show on the Isotope list.

Isotope Report

Isotope Reports can be generated showing all the parameters for individual isotopes or listing all the isotopes. These printouts can be accessed by selecting the <Report> icon in the primary tool bar.

Isotope Efficiencies

(See Figures 3-10 and 3-11.)

All efficiencies are set to zero as shipped from the factory. The user has the choice of either calculating the efficiencies to be used or using the analytically determined factory defaults.

NOTE: The total efficiency for an isotope using the system is the Geometric efficiency times the detector efficiency . See Apendix A for more details.

NOTE: An isotope will not be available for use for Wipe Testing or Bioassay unless an efficiency has been set to other than zero.

Setting Geometric Efficiency

The geometric efficiency for the system is independent of the isotope being used. The geometric efficiency refers to the placement of the isotope in relation to the detector.

1. From any screen, click on the <Isotope> icon in the primary tool bar. The Isotope Editing screen should now be displayed.

2. Click on <Efficiency> in the screen tool bar. The Detector Efficiency screen should now be displayed.

3. Click on <Set> in the Geometric Efficiency box and then select either well or probe. You can now enter information concerning the selected detector.

   NOTE: If you select probe, you would enter the outside diameter of the detector and the distance from the probe. This uses a formula described in Appendix A under Isotope Efficiency Calculation. You must enter the same unit of measure for both of these numbers. It is suggested to use centimeters for these as there is a cm scale for distance from the face of the detector on the collimator. The factory preset for the outside diameter is 5.08cm, which is the 2-inch diameter detector. The distance from the probe is the distance from the end of the distance bar to the face of the crystal. For the well it is the inside diameter, which on the well shipped by Biodex, is 1.905cm. Factory set well depth is 2.54cm. This depth in the well would be indicative of many wipes where the center of the activity or where the wipe would be located when lowered into the well. This would be the depth from the top of the crystal, not from the top of the lead of the collimator.

4. Once you have set the desired numbers, click <OK> to return to the Detector Efficiency screen. If a different efficiency than the one you desire is displayed on the Detector Efficiency window, double click on the box next to the appropriate detector and type in the efficiency you desire.

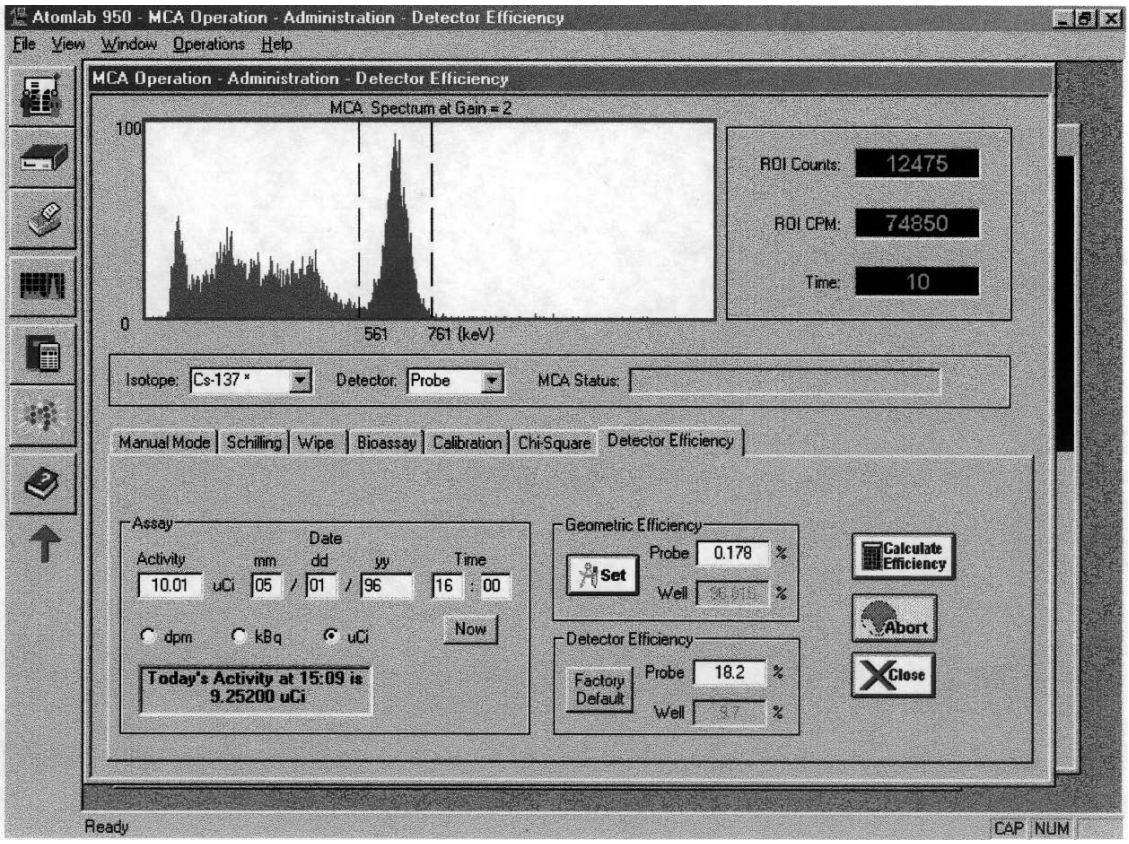


Figure 3-10. The Detector Efficiency Screen.

DETECTOR EFFICIENCY

To Enter A Detector Efficiency

1. From any screen, click on the <Isotope> icon in the primary tool bar. The Isotope Editing screen will be displayed.

2. Click on <Detector Efficiency> at the bottom of the screen. The Detector Efficiency screen will be displayed.

3. At the Detector Efficiency screen, double click on the box next to the appropriate detector and key in the new detector efficiency value. The value entered will be the efficiency used for the isotope indicated in the isotope window. Each isotope must be set individually for an isotope efficiency.

   NOTE: If the efficiency is less than one (1), it must be entered in decimal format (i.e., 0.1, 0.2, etc.)

4. Click on <Close> to return to the Isotope Editing screen.

To Select a Factory Default Detector Efficiency

NOTE: The following procedure is for selection of a factory default detector efficiency which was obtained using an analytical approach to efficiencies for a sodium iodide detector.

1. From any screen, click on the <Isotope> icon in the primary tool bar. The Isotope Editing screen will be displayed.

2. Click on <Detector Efficiency> at the bottom of the screen. The Detector Efficiency screen will be displayed.

3. Highlight the appropriate detector and the appropriate isotope.

4. Click on <Factory Default>.This will place the analytically determined factory default value into the appropriate detector window.

5. Click on <Close> to return to the Isotope Editing screen.

To Calculate a Detector Efficiency for a Specific Isotope

1. From any screen, click on the <Isotope> icon in the primary tool bar. The Isotope Editing screen will be displayed.

2. Click on <Detector Efficiency> at the bottom of the screen. The Detector Efficiency screen will be displayed.

3. To calculate a detector efficiency for a specific isotope, a sample of the activity with a known calibration date and time must be prepared. Enter this activity (preferably in microcuries) in the assay window at the bottom left of the Detector Efficiency screen.

   NOTE: If the activity is less than one (1), it must be entered in decimal format (i.e., 0.1, 0.2, etc.)

4. Enter the date and time of calibration of the standard. Today's activity at the current time is shown in the window below the assay window.

   NOTE: Click <Now> to instantly make current the date and time for the activity shown. This is convenient if you are making up a standard which you wish to count. You can then adjust from the current time to the calibration time of your standard.

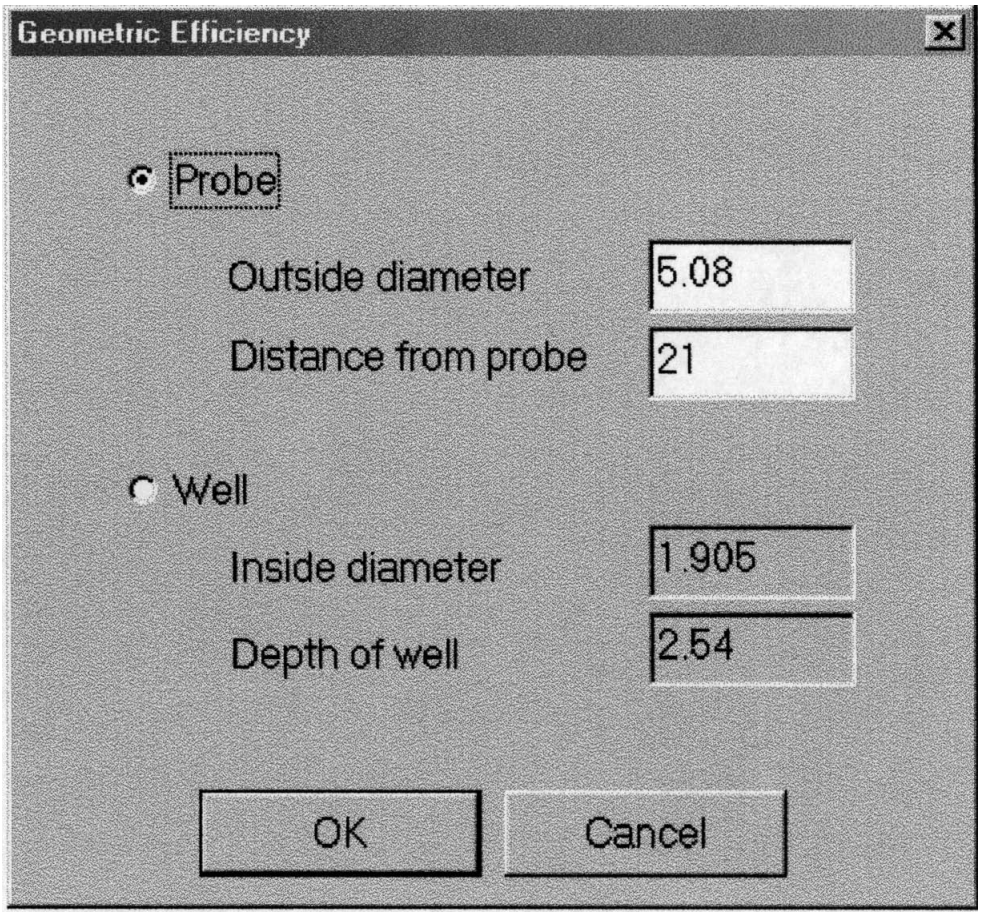


Figure 3-11. The Geometric Efficiency Window.

5. Click <Calculate Efficiency>. A window will be displayed telling you to prepare to count Background. Ensure there are no isotopes in the area before you click <OK>.

6. Once you click on <OK>, the system will proceed to count for 100 seconds. When it is done counting, a menu will be displayed telling you to place an isotope at the proper distance from the detector and to click <OK> when ready. When you click <OK> this time, the system will again start counting for the isotope for a 100 second time frame. When the system has finished counting for 100 seconds, calculated detector efficiency for this isotope will be displayed starting with the activity that you have entered.

Decayed Activity

To determine the decayed activity of a source: (For example, the current activity of a sealed Co-57 source.)

1. Open the Detector Efficiency page.

2. Select the desired isotope by clicking on the <down arrow> and selecting the desired isotope.

3. In the Assay window, click on either <Bq> or <µCi>.

4. Enter the calibration time and date for the source.

5. Enter the activity at the time of calibration.

6. In the window at the bottom of the screen you'll see listed "Today's Activity at the current time is _____."

SPECTRUM ANALYSIS

(See Figures 3-12 and 3-13.)

Spectrum Analysis is available in any operational mode throughout the program. This option allows the user to change the ROI on the display, add additional ROI's, or print the spectrum with counting information.

To Access The Spectrum Analysis

1. Click on <Spectrum> in the primary tool bar. The Spectrum Analysis screen should now be displayed.

   The spectrum from the immediately preceding count is shown with its associated data. On the Spectrum Analysis screen, the ROI for the isotope counted is shown on the screen. The set window for that isotope is displayed in the bottom of the Cursor Window. The left channel is shown in the Select Left Cursor box while the right channel is shown under the Select Right Cursor box. The Select Data Cursor is your cursor that can be moved.

2. To move any ROI or cursor, click on the box for the appropriate line and then use the <Up> or <Down> arrows under the cursor. As you move the cursor, the energy and counts associated with that channel will change.

   - On the right hand side of the screen, the cursor window shows the energy between lower and higher keVs set by the ROI shown to the left.

   - The counts are the counts in that region of interest. The count rate is the rate in the region of interest that the cursor is in, displayed in cpm.

   - The full width half max (FWHM) is displayed for the appropriate peak in that window.

3. To choose a different isotope, click on Set Window and highlight the desired isotope from the isotope list. The window will switch to that keV setting and display it.

   NOTE: The >> button to the right of the Set Window can be used to cycle through the isotope list while displaying the regions of interest for all the factory and custom isotopes that are stored in memory. This can help identify an unknown peak that is on your display. If you use this feature to go to a lower gain isotope, the system may display a message that the lower limit of deection of Co-58 is above the window limit of the selected gain. This message will be displayed for each isotope until you select one that has an acceptable gain. Click on <OK> to remove the message window and select another isotope.

4. To set multiple regions of interest on the screen, click on <Show/Hide Cursors> in the Cursor Window. You can now click on <Select Left Cursor> or Select Right Cursor> and move the cursor to the desired point. Use the <Up> and <Down> arrows to refine this setting.

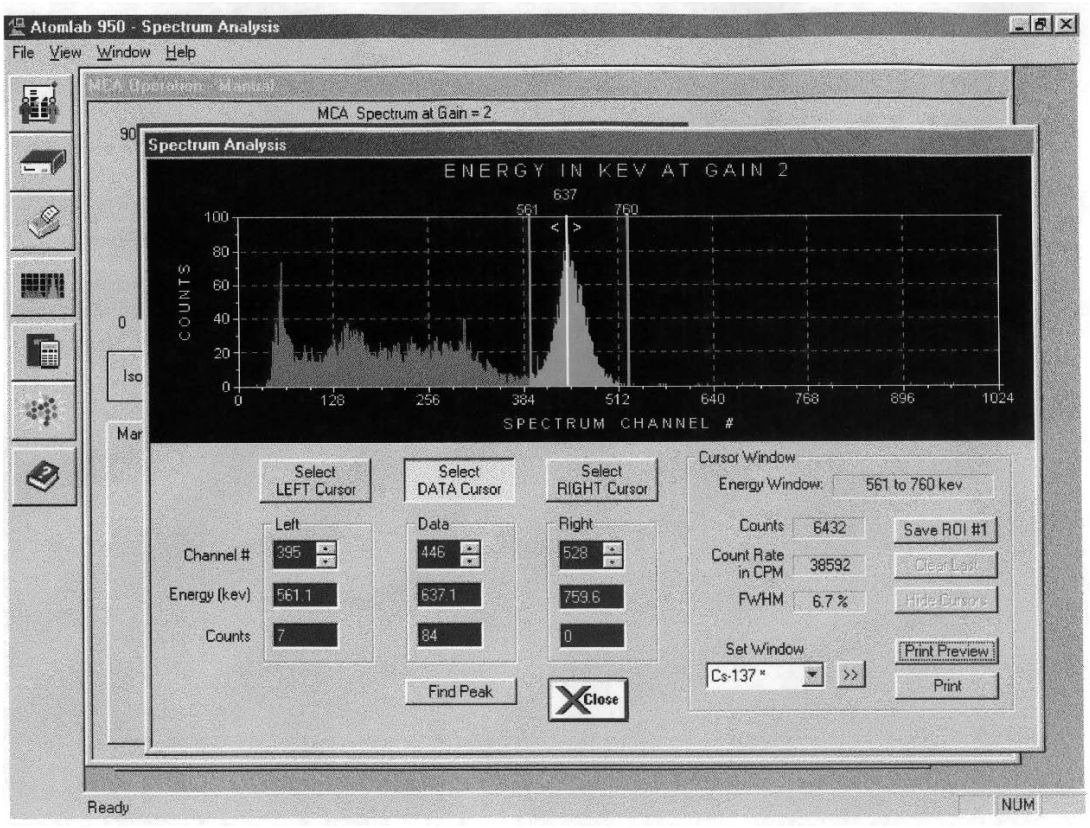


Figure 3-12. The Spectrum Analysis Screen.

5. To find the peak in the ROI, click on <Find Peak>. Click on <Save> to save this second region of interest as ROI #2. To create additional regions of interest, click on <Show Cursors> and repeat steps 4 and 5.

6. To print a Spectrum Analysis Report, click on <Print Preview> at the bottom right of the Cursor Window for a preview. To print the report, click on <Print>.

7. To exit Spectrum Analysis, click on <Close> at the bottom center of the Spectrum Analysis screen.

How is ROI Determined?

The preset ROI energy window values do not change as the user switches between well or probe, regardless of the mode selected (i.e., Uptake, Schilling, MCA, etc.). The ROI is defined in units of energy (keV) and then converted to channel numbers with the keV/channel slope value that is measured during calibration. The channel number for the ROI values can and will change from probe to well if the calibration keV/channel is different between probe and well.

Example

Tc-99m has a peak energy of 140 keV according to the radionuclide decay scheme. The Atomlab 950 uses a default of +/- 15% energy window around the peak energy. These values calculate to be 119 keV to 162 keV and are displayed on the Isotope Editing page. When either the probe or well is selected, the ROI channels are calculated based upon the Cs-137 calibration results for that particular detector. If the calculation of the probe results in a .3775 keV/channel on gain 8, the TC-99m default gain, the channel ROI will be 119 keV/.3775 keV channel = channel 315 and 162/.3775 = channel 429. For the well detector, we might have a calibration of .3325 keV/channel. In this case, the ROI channels will calculate channel 358 to 487. Even though the ROI channels are different, the energy windows are the same. This will become apparent when the spectrum for each detector is printed.

NOTE: It is not necessary to fix a symmetrical percent around the peak. In fact, some isotopes are multi-peaked, which can cause an asymmetric spectrum. Keep in mind that if a calibration is performed you must save the result in order to have it used in ROI calculations.

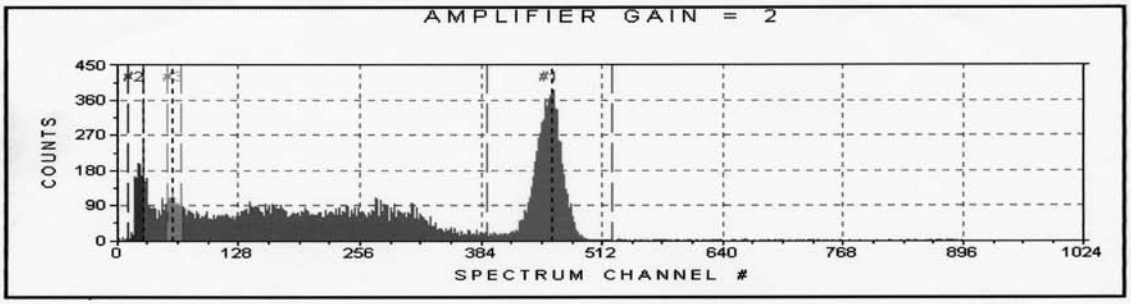
If you select an isotope from the Isotope Editing page, the screen will display the isotope name, LLD, ULD, and gain setting as demonstrated in the following chart.

Gain	Max keV	Half Scale
1	3000	1500
2	1500	750
4	750	375
8	375	187
12	250	125
48	64	32

A. Lower Level Discriminator (LLD) = 0.85 times the Min keV of interest.
B. Upper Level Discriminator (ULD) = 1.15 times the Max keV of interest.

Your Hospital Name
Address
City, State Zip
(000) 000-0000

Spectrum Analysis Report



Spectrum acquired on Thursday, February 05,2004 at 09:34 AM

Counting Parameters

Isotope:	Cs-137	**Detector:**	Well
Gain:	2	**Count Time (sec):**	31

ROI Statistics

ROI #	ROI (kev)	ROI COUNTS	ROI CPM	CURSOR (kev)	CURSOR COUNTS	CURSOR CPM
● 1	560 to 760	75501	146130	664	387	749
● 2	14 to 35	8681	16801	33	239	462
● 3	69 to 88	8764	16962	74	134	259

Figure 3-13. A Spectrum Analysis Report.

4. THYROID UPTAKE

In this mode, a radioactive uptake study is performed. The system guides the user through a step-by-step procedure that includes counting the following: standard, lab background, patient thyroid, patient background, and finally the computation of the uptake percentage. The uptake percentage, which is calculated from an automatically decay corrected dose count or recounted standard, can then be printed in a format designed to provide complete information on the patient study.

The system allows multiple data sets for different times for the patient. Once you have created or selected a patient, you can come back and do an uptake (example: 2 hr, 4 hr, 6 hr or 24 hour.) The system assumes when you have counted the dose and lab background that you are immediately giving this dose to the patient.

When the patient comes back at the appropriate time to count thyroid, the system calculates the elapsed time between when the dose was counted and when the thyroid is being counted. This is listed in tenths of an hour used for the calculation. With the system performing an automatic decay correction, you do not need to bring the patient back at exactly six hours. The time could, for example, be 6.2 hours because the system will calculate for the elapsed time.

Each of the data sets that are counted are displayed in the status window on the Thyroid Uptake screen.

NOTE: If you have not yet calibrated your Atomlab 950 on this day, the system will prompt you to calibrate before proceeding with the Thyroid Uptake or any other mode selected. High Voltage must also be set before using the system for the first time. Once the calibration and High Voltage have been performed, you may proceed.

Defining Facility Standard Uptake Procedures

The Procedure Definition option allows the user to define procedures to be used in Thyroid Uptake and other modes of operation.

To Define A Facility Standard Uptake Procedure
(See Figure 4-1.)

1. Click on <Procedure Definition> in the primary tool bar. The Procedure Definition screen should now be displayed.

2. Click on <Add> in the screen menu.

3. Enter the procedure name in the Procedure Name box.

4. Select the desired isotope from the Isotope box.

5. Select/define the remaining parameters for this thyroid procedure (i.e., count pre-dose patient background, procedure type, count type, count time and report options.)

6. Click on <Save> to save the new procedure and return to the Operation screen.

NOTE: To view or modify any preset or existing procedures, click on <Open> in the Procedure Definition screen. You can then choose a procedure from the procedure list and edit appropriately in standard Windows fashion as described for the Patient Definition screen.

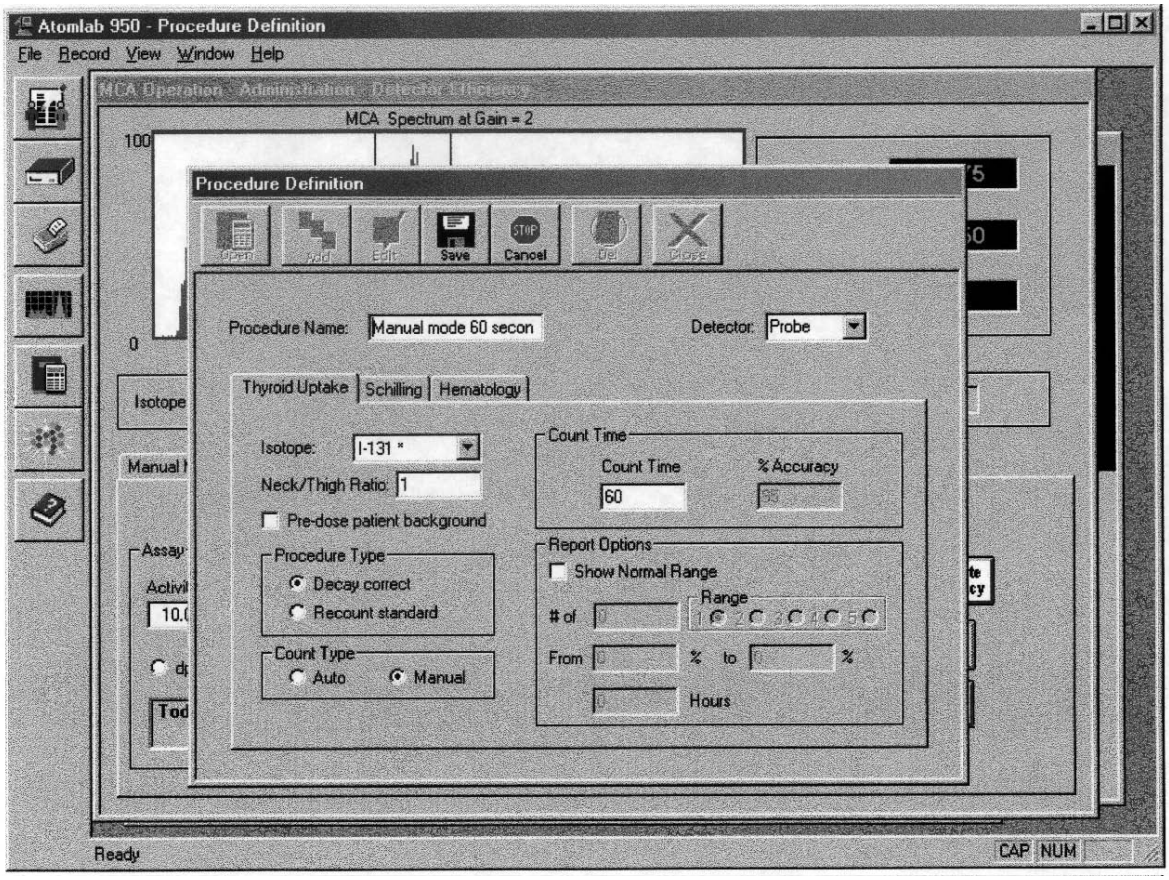


Figure 4-1. The Procedure Definition Screen.

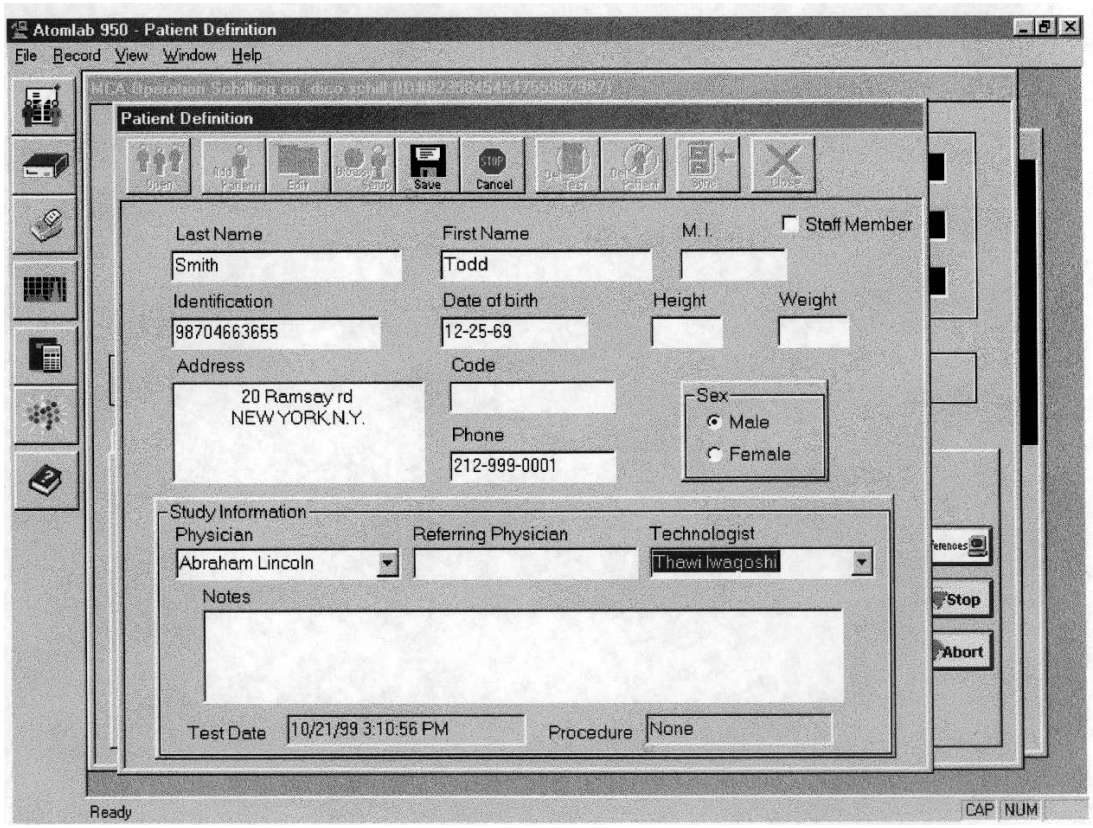


Figure 4-2. The Patient Definition Screen.

The Patient Definition Screen

(See Figure 4-2.)

On this page, the user can add a new patient, edit existing patient information or select an existing patient to study. All pertinent information regarding the patient is displayed on this page. Fields are provided for the Patient Name, Identification Number, Address, Phone Number, Height, Weight, Sex, Date of Birth. The Study window, at the bottom of the screen, provides fields for Physician, Referring Physician, Technologist, Notes, Test Date and Procedure.

To Select an Existing Patient

1. To select a patient that has already been entered into the system, click on the <Patient Definition> icon in the primary tool bar. The Patient Definition screen should now be displayed.

2. Click on <Open> in the screen tool bar. The Patient List should now be displayed.

3. Double-Click on the desired patient to select that patient. The Patient Definition screen should now be displayed with the new patient selected.

4. Click on <Close> to return to the Operation screen. The selected patient should now appear at the top of the screen.

To Edit an Existing Patient

1. To edit an existing patient, click on <Patient Definition> in the primary tool bar. The Patient Definition screen should now be displayed.

2. Click on <Edit> in the screen tool bar. The Patient List should now be displayed.

3. Double-Click on the desired patient to select that patient. The Patient Definition screen should now be displayed with the patient to edit selected.

4. Make the necessary edits by highlighting each parameter to edit, then keying in the new information.

5. Click on <Save> to save the edits.

6. Click on <Close> to return to the Operation screen. The edited patient should now appear at the top of the screen.

To Add a New Patient To the Patient List

1. To Add a new patient to the Patient List, <Patient Definition> in the primary tool bar. The Patient Definition screen should now be displayed.

2. Click on <Add> in the screen tool bar. The fields on the Patient Definition screen should now be highlighted.

3. Enter all pertinent information on the Patient Definition screen and in the Study Information window at the bottom of the screen.

4. Click on <Save> in the screen tool bar to save the new patient. The System will prompt you to add a procedure to the patient file.

5. Click on <Okay> to access the Procedure Selection screen. Click on <Expand All> or <+> to show the patient information. Highlight the desired procedure and click on <Select>. The system now returns to the Operation screen.

NOTE: If there is an existing patient and at some future time another uptake study with a new dose will be administered, you would go to the Patient Definition screen, select the desired patient, and either select an existing study or click on <Add Test To Selected Patient>. This allows the addition of a new test to the selected patient. This can be another uptake study with a new dose, a Schillings test or some other function.

DETERMINING AUTOMATIC COUNT TIME

If automatic counting is selected in the Procedure Definition, the time period for each measurement becomes a variable. Measurement will continue until a predetermined accuracy is reached as determined by random counting statistics.

For automatic measurements, statistical uncertainty is user defined (i.e., 1%, 3%, 5%, etc.). The time is based on the radioactive level of activity being measured, the background level, the type of measurement being made, and the user selected percent accuracy. The system performs an internal check to ensure the count was accomplished with an acceptable degree of certainty (i.e., appropriate counting rate, proper spectrum, etc.). The level of accuracy is also set from the Preferences screen.

With automatic counting selected, each count time for a thyroid uptake measurement is automatically determined, using counting statistics, by imposing an overall accuracy requirement on the uptake result. There are four count times which comprise an uptake measurement: Standard, Lab Background, Thyroid and Patient Background. Each count resulting from a lapsed count time has a statistical uncertainty which is related to the count. When these four independent counts are combined to yield the uptake value, the uncertainties must also be combined to yield the total uncertainty of the uptake. This total uncertainty is preset by the user, in Setup Preferences, when the instrument is installed.

At the start of an uptake procedure, the total uncertainty is partitioned between the four count times in a rational way which minimizes the count times for all four counts and thereby minimizes the amount of time the patient must remain immobile. Because the count rate is high, the Standard count time is usually short (~6 seconds). Time for the Lab Background is determined from the first few seconds of Lab Background counting. If the count rate is very low, the count time will be short because the net error of (Std.-Bkgd.) contains only a term proportional to (Bkgd. rate/Std. Rate).

Thyroid count time is also determined during the first few seconds of Thyroid counting. It is calculated from the approximate Thyroid rate and the Standard count rate in such a way that the Thyroid measurement uncertainty will be only a fraction of the total target uncertainty. Finally, the Patient Background is determined during its first few seconds of counting with the requirement of the total uncertainty satisfying the accuracy goals.

Examples
The following academic numerical examples should provide some idea of the four required measurement times in actual practice. Each example assumes a user-selected counting accuracy requirement of 98%. This means that there is a 2% allowed counting error at the 90% confidence level. If you repeat each of the four measurements and calculate the uptake, nine out of ten results will fall within 2% of the first measurement.

NOTE: You must select the accuracy requirement in the Uptake Procedure Setup loop. The factory setting is 95%, if you want 98% as illustrated in this example, you must select it. The counting times get longer with higher accuracy requirements.

NOTE: The "2%" uncertainty is only with respect to detector counting. If a measurement is "repeated" with repositioning of the standard or patient, there will be additional geometry setup errors which will add to the counting errors.

NOTE: The % uncertainty is not an uptake %, but a percentage of the uptake. For example, if the uncertainty is 2% and the uptake is 50%, then the uncertainty is 2% of 50%, or ±1%, and the uptake range could be 49% to 51%. If the uptake was 10%, the uptake could be 9.8% to 10.2% (2% of 10% is 0.2%).

Maximum Count Time
All of the following examples had a 60 sec maximum count time set in the Uptake SETUP loop. The first example did not require longer than 60 seconds on each measurement to satisfy the 98% accuracy requirement. The next two examples did require a longer than 60 seconds on each measurement to satisfy the 98% accuracy requirement. The next two examples did require a longer than 60 seconds on some of the measurements but the actual time was limited to 60 seconds automatically. The uncertainty resulting from such a shortened time is stated with the example.

Minimum Count Time
The minimum count time for any count in the uptake mode is 10 seconds. This is illustrated in all three examples during the lab background count.

EXAMPLE 1: I-123, 6 HOUR UPTAKE, 98%, 60 SEC MAX COUNT TIME

	cpm	Actual Count Time	Computed Auto Time
Measured Standard	538,920	53 sec	53 sec
Measured Lab Bkgnd	64	10 sec	2.2 sec
Decayed Standard	(393468)	—	—
Measured Thyroid	108,060	29 sec	29 sec
Measured Pat. Bkgnd	7,500	12 sec	12 sec
Uptake = 25.5% ± 2% (25.1% to 26.1%)			

Comment
The automatic time selection controlled the counting since all times were less than the maximum set count time of 60 sec. The patient was required to remain in a counting position for only 29 seconds for the thyroid and 12 seconds for the background count. This is very beneficial for hyperthyroid and elderly patients. Plus the auto-count time mode takes less time to set up. The Uptake of 25.5% has a 2% uncertainty meaning it could be 25.1% to 26.1%.

NOTE: In this example, and the following two, the "pill" was counted at the time of administration (Measured Standard) and the count rate was decayed to the time of the thyroid count (value in parenthesis).

EXAMPLE 2: I-123, 6 HOUR UPTAKE, 98%, 60 SEC MAX COUNT TIME

	cpm	Actual Count Time	Computed Auto Time
Measured Standard	538,920	53 sec	53 sec
Measured Lab Bkgnd	64	10 sec	2.2 sec
Decayed Standard	(393468)	—	—
Measured Thyroid	36,000	60 sec	119 sec
Measured Pat. Bkgnd	12,000	60 sec	81 sec
Uptake = 6.1% ± 2.3% (5.96% to 6.24%)			

Comment
The uptake was about one fourth the values as in example 1 in order to illustrate the change in counting time required for uptake and patient background. If the maximum set count time was 120 seconds, then the actual counting times for the thyroid and patient background would have been 119 and 81 seconds respectively. The standard and lab count rates were kept the same for demonstration purposes.

Note: Even though the actual count times were lower than the required time for a 2% uncertainty, the times used (thyroid time almost 1/2 of the computed value) resulted in only an increase of 0.3% uncertainty. This is certainly not significant, particularly in view of the low uptake where count times will tend to be longer because of the lower count rates.

EXAMPLE 3: I-123, 6 HOUR UPTAKE, 98%, 60 SEC MAX COUNT TIME

	cpm	Actual Count Time	Computed Auto Time
Measured Standard	120,000	55 sec	55 sec
Measured Lab Bkgnd	300	10 sec	5.3 sec
Decayed Standard	(87612)	—	—
Measured Thyroid	12,000	60 sec	156 sec
Measured Pat. Bkgnd	3,600	60 sec	90 sec
Uptake = 9.6% ± 2.8% (9.33% to 9.87%)			

Comment
In this example, we see much lower rates in the standard and thyroid counts. However, the standard count time only increased by 2 seconds. The reason for this is twofold. First, the equations for time computation derived from counting statistics are nonlinear. Second, pulse height analysis at the higher counting rates takes a longer period of time.

The increase in lab background time is due to the increase in lab counting rate and how the standard and lab rates are treated in the analysis. The lab is subtracted from the standard. Any error in the lab is carried forward into the overall error, but the impact depends upon the relative counting rates. If the standard is 10,000 times higher than the lab, then a 50% uncertainty in the lab will only contribute a very small error to the difference. As the lab rate increases with respect to the standard, its error contribution will also increase which will require a more precise measurement of the lab.

The thyroid count time increased significantly but the actual count time again was only 60 seconds because of the maximum time set. Note the increase in the uptake uncertainty went to 2.8%, due to the reduction of actual counting times from time values which were required for the thyroid and patient background measurements.

PERFORMING A THYROID UPTAKE

(See Figure 4-3.)

To Perform A Thyroid Uptake

1. Click on <Patient Definition> in the primary tool bar. Select an existing patient, edit an existing patient, or create a new patient to test. For existing patients, proceed to step 3. If you have just created a new patient, click on <Close>.

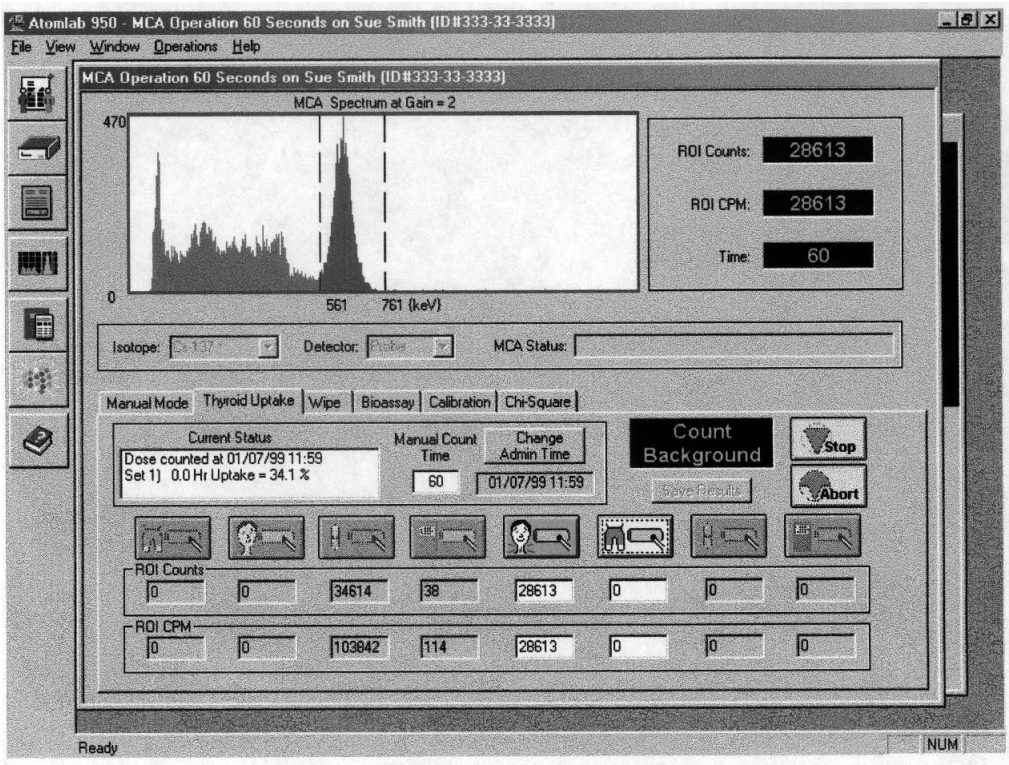


Figure 4-3 The Thyroid Uptake Screen.

NOTE: You can access the Patient Definition screen from any other screen by simply clicking on <Patient Definition> in the primary tool bar. After selecting a patient, you can then access any mode of operation with the new patient selected.

2. For existing patients, click on the patient name to reveal the studies. Double-click on the desired study to return to the Thyroid Uptake screen with the patient and study selected.

3. The Thyroid Uptake screen should now be displayed. At the top of the screen should be the currently selected patient and I.D. number. Confirm that this is the correct patient and correct I.D. number for the patient to be tested.

4. Position the capsule(s) in the thyroid phantom and set up the collimator for use. Set the distance on your distance bar and move the collimator down to this distance. The capsule count distance and the thyroid count distance must be the same for all counts.

5. If testing an existing patient, proceed to step 9. For a new patient, click on the <Capsule> icon (third from left, above the time titled ROI Counts) to begin counting. The message "Counting Dose" appears on the right of the screen. The current system status is displayed on the left side of the screen in the "Current Status" box.

   NOTE: Once counting begins, the counts are shown in the spectrum at the top of the screen. ROI counts, ROI cpm and elapsed time are indicated in the upper right. When the system finishes counting, it will stop and do a final download for the best spectrum. If you desire to do a spectrum analysis, click on the <Spectrum> icon in the primary tool bar.

6. Remove the capsule from the neck phantom and position the probe to measure lab background. Click on the <Lab Background> icon (fourth from left, above ROI counts) to begin the lab background count. In auto count time, the system will calculate the count rate and adjust the counting time automatically. For manual counting, the system counts for the time selected.

7. When the lab background count is complete, the system prompts the user to save the dose count results. Click on <Yes> to save the results.

   NOTE: If you are not satisfied with the results for dose or lab background, click <No>. You can then reposition for the appropriate count and click the desired icon to recount for that function.

8. When you are finished counting the dose and lab background, save the results.

9. Give the dose to the patient.

   NOTE: If you do not immediately give the dose to the patient, you can correct the administration time by clicking on <Change Administration Time>.

10. Tell the patient when to return.

11. When the patient returns, go to the Patient Window and select the patient and study. The system will display the thyroid counting page. If you are using decay correction <Count Thyroid> will be highlighted.

12. Position the probe over the patient's neck.

13. Click on the <Thyroid Count> icon (fifth from left, above ROI counts) to begin the thyroid count.

14. Once the thyroid count is complete, position the probe over the patient's thigh. Click on <Patient Background> (sixth from left, above ROI counts) to begin the patient background count.

Your Hospital Name
Address
City, State Zip
(000) 000-0000

Detailed Uptake Report

Printed on Monday, February 02,2004 08:45 AM

Patient

Name: Sample Thyroid Uptake **Ref. Physician:**

ID: 000 **Code:**

Radionuclide Administration

Isotope: I-131 **Activity (uCi):** _____

Detector: Probe **Count Type:** Manual

Date: March 23,1998 04:16 PM

Uptake Results

Dose Count Rate (cpm): 326766

Lab Background (cpm): 24

Set	Count Time	Thyroid cpm	Patient bkg cpm	Corrected Dose(cpm)	Thyroid Count Time Stamp	Hours	Uptake
1	60	30000	60	319775	03/23/98 10:16 PM	6.00	**9.4%**
2	60	88302	12	281598	03/25/98 09:39 AM	41.39	**31.4%**
3	60	75852	60	256921	03/26/98 11:11 AM	66.92	**29.5%**
4	60	61332	48	217331	03/28/98 09:46 AM	113.51	**28.2%**
5	60	42480	48	167756	03/31/98 09:51 AM	185.59	**25.3%**

Technologist: Sharon Johnson

Comments: This is a sample uptake

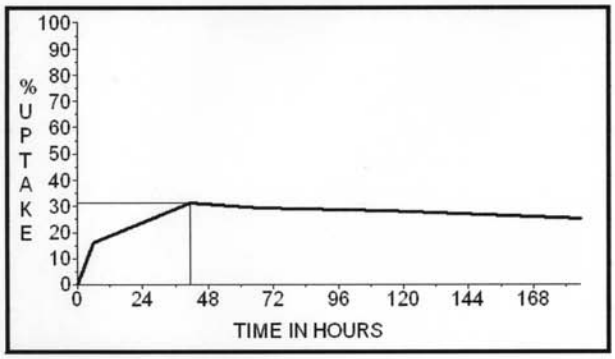
Physician: _____ **Date:** _____

Software version 3.36, Unit Serial # 11111

Figure 4-4. A Thyroid Uptake Report.

Your Hospital Name
Address
City, State, Zip
(000)-000-0000

Time Activity Report



Radionuclide

Date:	03/23/98
Isotope:	I-131
Activity (uCi):	_
Detector:	Probe
# of Samples:	5
Dose Count Rate (cpm):	326766
Lab Background (cpm):	24

Patient

Name: Sample Thyroid Uptake **Code:**
ID: 000 **Ref.:**

Set	Count Time	Thyroid cpm	Patient bkg cpm	Corrected Dose(cpm)	Hours	Uptake
1	60	30000	60	319775	6.00	**9.4%**
2	60	88302	12	281598	41.39	**31.4%**
3	60	75852	60	256921	66.92	**29.5%**
4	60	61332	48	217331	113.51	**28.2%**
5	60	42480	48	167756	185.59	**25.3%**

Maximum Uptake = **31.4%** at **41.4** Hours
Biological Half Life = **461.4** Hours Absorbed dose = **0.00** Rads

Technologist:
Comments: This is a sample uptake

Signature: _____ **Date :** _____

Software version 3.36

Figure 4-5. A Time Activity Report.

15. When patient background counting is complete, the system displays a message that "A Thyroid Uptake Is Complete" and prompts you to save the results. If you click <Yes> the results are stored and cannot be changed. If you click <No> and do not save the results, the system allows you to recount the thyroid and patient background. It is recommended that the results be saved if they are satisfactory.

    After saving the thyroid uptake results, the system returns to the MCA Operation screen. You can now use the system for other operations if desired. If you come back to this patient at a later time, follow steps 1-3 and then go to step 11.

    NOTE: Click on <Stop> at anytime to stop counting and use the counts up to that point for results. Click on <Abort> to cancel the current counting operation without using the current count. You can then go in and manually change the numbers if you have selected this option in your procedure definition.

16. If you are using a procedure to recount a standard, the system will highlight the button to count the standard.

17. Place the standard in the neck phantom.

18. Click <Count Standard>.

19. Remove the standard from the phantom and store it away.

20. Count the empty phantom to obtain the current lab background count.

21. The system now displays a prompt to save results. Click <Yes> to save the results with the number. Click <No> to redo any count.

22. When satisfied, save the results.

After saving the thyroid uptake results, the system returns to the MCA Operation screen. You can now use the system for other operations if desired. If you come back to this patient at a later time, follow steps 1-3 and then go to step 11.

Printing A Thyroid Uptake Report

(See Figure 4-4.)

1. After saving a Thyroid Uptake as described above, click on the <Report> icon in the primary tool bar. The Report Generation screen should be displayed.

2. Click on the desired parameters, including Thyroid Uptake test, then key in the Technologist name (or select the desired name from the pull-down technologist list). Key in dose activity and any comments to be printed on the report.

3. Click on <Preview> if you want to preview how the report will look when it is printed.

4. Click on <Print> to print the report.

5. Click on <Close> to return to the Thyroid Uptake screen.

Printing A Time Activity Uptake Report

(See Figure 4-5.)

The Time Activity Curve plots a decay curve showing the decay of the isotope in the thyroid. Several data sets must be counted before printing this report. The report should be printed when half the original rate remains in the thyroid.

1. After saving a Thyroid Uptake as described above, click on the <Report> icon in the primary tool bar. The Report Generation screen should be displayed.

2. Click on the desired parameters, including Time/Activity for Thyroid Uptake, then key in the Technologist name, dose activity and any comments to be printed on the report.

3. Click on <Preview> if you want to preview how the report will look when it is printed.

4. Click on <Print> to print the report.

5. Click on <Close> to return to the Thyroid Uptake screen.

   NOTE: Results can be listed in rads or in grey units of measure. See Section 2, "System Set-Up."

6. Click on <Print> to print the report.

7. Click on <Close> to return to the Manual Mode screen.

5. MANUAL MODE

The MCA Manual mode is used as a rate counter that functions in either a Preset Time, Preset Count or Continuous Counting mode. You can press Spectrum for any count that you take in this mode and create reports from the data obtained. The standard ROI is determined by the isotope that you are counting and the spectrum analysis page will allow you to create multiple ROI's or change the ROI displayed.

To Count In Manual Mode

(See Figures 5-1 and 5-2)

1. From the Operation screen, click on <Manual Mode>. The Manual Mode screen should now be displayed.

2. Select the desired <Isotope> and <Detector>.

3. Toggle on <Preset Time>, <Preset ROI Counts> or <Continuous Counting> and enter the desired count time or number of counts.

   - Preset time count: When counting by preset time, the system counts for the time entered.
   - Preset ROI count: The system counts to just beyond the number of ROI counts entered.
   - Continuous counting: The system will count until <Stop> is pressed.

4. Click on <Start>. The system displays a message on the right side of the screen stating that a test is in progress. The spectrum is displayed at the top of the screen, along with the associated time, counts and cpm.

   NOTE: Click on <Stop> at anytime to stop counting and use the counts up to that point for results. Click on <Abort> to cancel the current counting operation without using the current count. The system will return to the Manual Mode screen.

5. Once the count is completed, the message "Test Completed" is displayed. The results now appear in the Test Results window. You may now count again in manual mode to build a report with multiple counts, or exit to another mode.

   NOTE: Click on <Clear All> to clear all counts stored in the Test Results window. To remove a particular line from the window, highlight the line to be removed and click on <Remove>.

To Print a Manual Report

1. Click on the <Report> icon in the primary tool bar. The Report Generation screen should be displayed.

2. Click on the desired parameters, including Administration or Test. Key in the Technologist name and any comments to be printed on the report.

3. Click on <Preview> if you want to preview how the report will look when it is printed.

4. Click on <Print> to print the report.

5. Click on <Close> to return to the Manual Mode screen.

   NOTE: The Manual Report allows for listing of multiple isotopes. This allows the operator to perform any variation of the test or procedures deem desirable.

Spectrum Analysis

After any count is taken, the Spectrum Analysis option can be used to analyze counts in the spectrum and print a Spectrum Analysis Report if desired.

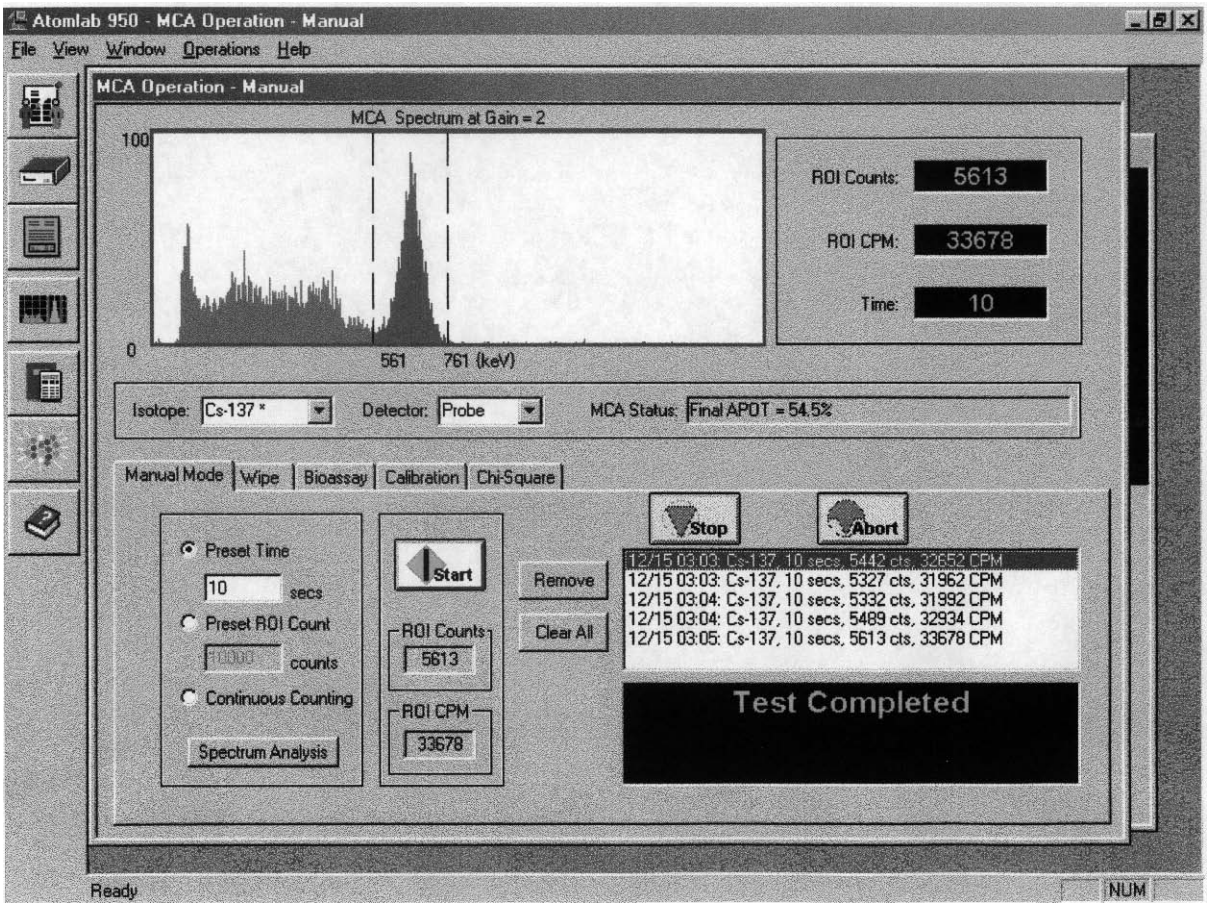


Figure 5-1. The Manual Mode Screen.

Your Hospital Name
Address
City, State Zip
(000) 000-0000

Manual Report

Counting Results

DATE	DETECTOR	ISOTOPE	ENERGY (kev)	TIME (sec)	ROI COUNTS	ROI CPM
03/14/03 10:02	Probe	Cs-137	494 to 671	15	9312	37248
03/14/03 10:18	Probe	Cs-137	494 to 671	15	9034	36136
10/24/03 04:32	Probe	I-125	21 to 37	7	9	77
10/24/03 04:38	Probe	I-125	16 to 32	15	38242	152968
10/24/03 04:54	Probe	Cs-137	512 to 696	15	1201	4804
10/24/03 04:55	Probe	Wide	17 to 1372	15	4675	18700
10/24/03 04:56	Probe	I-125	16 to 32	15	686	2744
10/31/03 02:25	Probe	Co-57	85 to 130	15	257	1028
12/10/03 03:11	Probe	Co-57	101 to 155	13	5358	24729
12/10/03 03:12	Probe	Cr-51	265 to 359	11	6780	36982
12/10/03 03:15	Probe	I-125	17 to 34	15	8989	35956
01/29/04 09:55	Probe	I-125	17 to 34	1908	34823	1095
01/29/04 11:22	Probe	Cs-137	543 to 739	4095	13392	196
02/05/04 09:31	Probe	Cs-137	559 to 757	15	1060	4240
02/05/04 09:32	Well	Cs-137	563 to 764	31	75501	146131
02/18/04 04:50	Well	Cs-137	560 to 759	15	36536	146144
02/23/04 04:09	Well	Cs-137	560 to 759	7	2	17
02/25/04 11:03	Well	Au-198	349 to 474	7	3	26
02/25/04 11:08	Well	64	18 to 27	7	0	0
02/25/04 11:10	Well	I-123	135 to 183	7	5	43
02/25/04 11:12	Well	Tc-99m	120 to 163	7	1	9
02/25/04 11:21	Well	I-123	135 to 183	7	1	9

Technologist:
Comments:

Physician: _____ **Date:** _____

Software version 3.36, Unit Serial # 999999

Figure 5-2. A Manual Mode Report.

6. WIPE TEST

(See Figures 6-1 - 6-5.)

The Wipe Test is used to determine the DPM of swipes taken in the designated areas of a department using the optional well counter Model #187-246. A total of 10 swipes may be identified and counted for each area. When wipe counting is completed, a report of the Wipe Test results can be printed out with each test identified by the area and wipe with results shown. The screen displays all wipes and stores the results for each wipe until that wipe is recounted.

NOTE: In Wipe Test and Bioassay mode, the activity shown is NET activity. This means that the background count is subtracted from the count before the activity is calculated. For all other modes, counts shown are the actual counts detected and are not netted for background.

Define Wipe Areas

The Define Wipe Areas feature is used to define new areas or change information about existing areas. At this screen, you can define individual wipe areas in the same manner as used for selecting, adding, editing or deleting patients and isotopes.

NOTE: You must use the Isotope Editing screen to make isotopes available for use in Wipe Testing, and the Isotope Efficiencies screen to enter the Detector Efficiency for each isotope. Refer to chapter 3 for details.

To Edit an Existing Wipe Area

1. To edit an existing Wipe Area, at the Operation screen click on <Wipe>. The Wipe Counting screen should now be displayed.
2. Click on the <Define Wipe Area> icon at the bottom of the screen. The Wipe Area Setup screen should now be displayed.
3. If the currently selected wipe area is the one you want to edit, proceed to step 5. To select another wipe area to edit, click on <Open> in the screen tool bar. The Wipe Area Selection List should now be displayed.
4. Double-Click on the desired wipe area. The selected wipe area should now be displayed on the Wipe Area Setup screen.
5. Click on <Edit> in the screen tool bar and then make the desired changes.
6. Click on <Save> to save the changes.

   NOTE: If you click <Cancel> the changes made will be discarded.
7. Click on <Close> to return to the Wipe Counting screen. The edited wipe area should now be displayed in the Area Name box.

To Add A New Wipe Area

1. To add a new Wipe Area, at the Operation screen click on <Wipe>. The Wipe Counting screen should now be displayed.
2. Click on the <Define Wipe Area> icon at the bottom of the screen. The Wipe Area Setup screen should now be displayed.
3. Click on <Add> in the screen tool bar. The fields on the Wipe Area Setup screen should now be highlighted.
4. Enter the new wipe area name and up to ten wipe locations in this area (i.e., Camera Room or Hot Room for area names, counter, table, etc. for locations.)
5. Select the area type: restricted, unrestricted or sealed source.
   NOTE: If you select a sealed source area only one isotope is allowed. For restricted and unrestricted areas, multiple isotopes can be used.

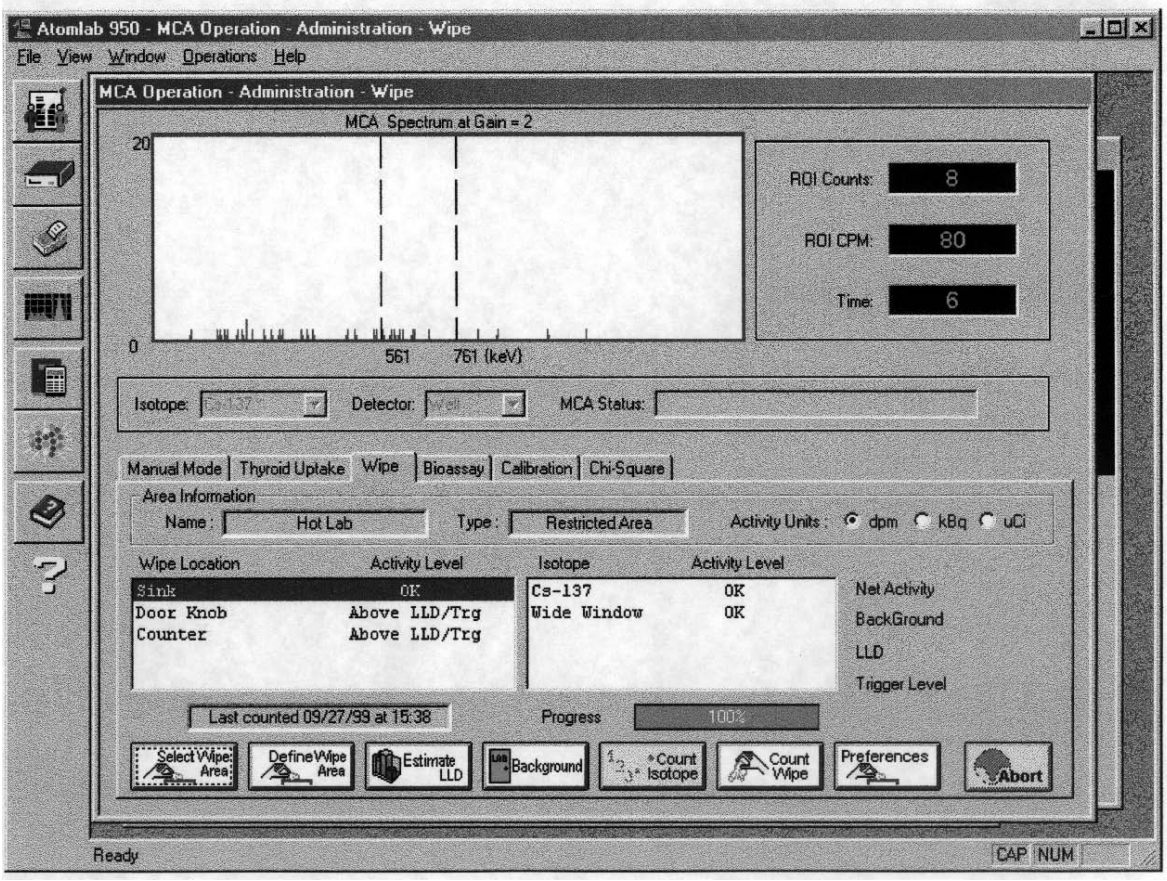


Figure 6-1. The Wipe Counting Screen.

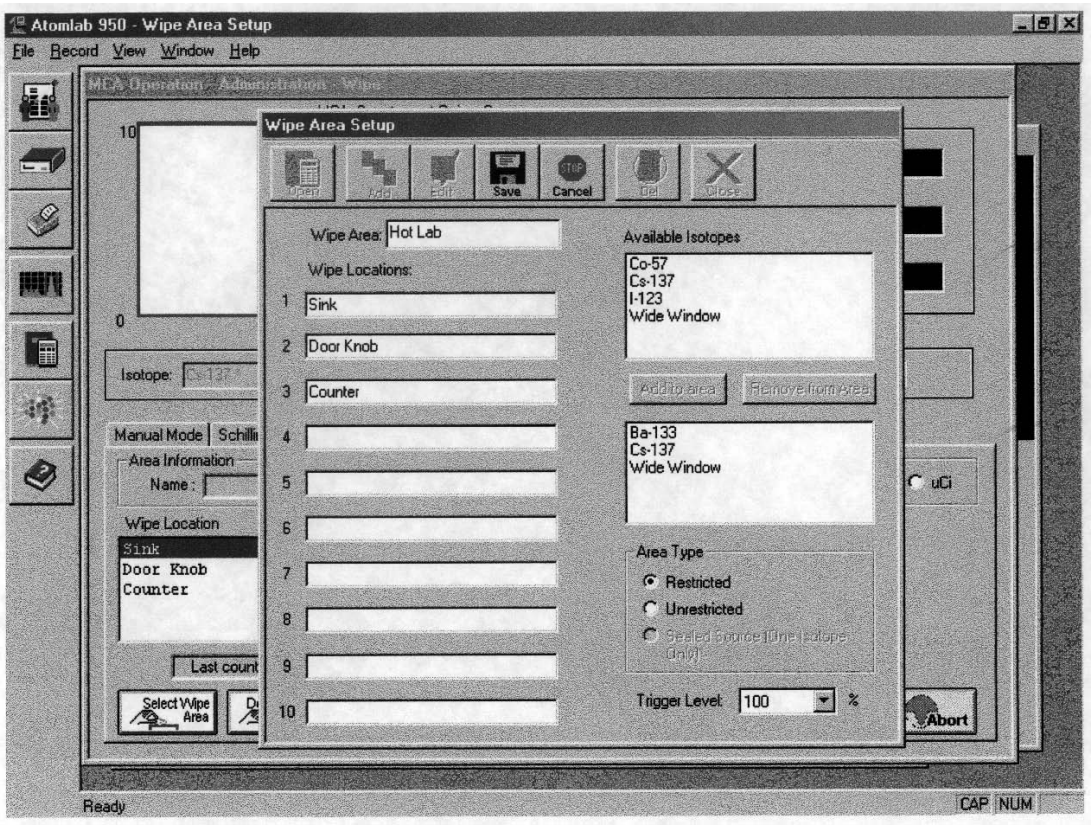


Figure 6-2. The Wipe Area Setup Screen.

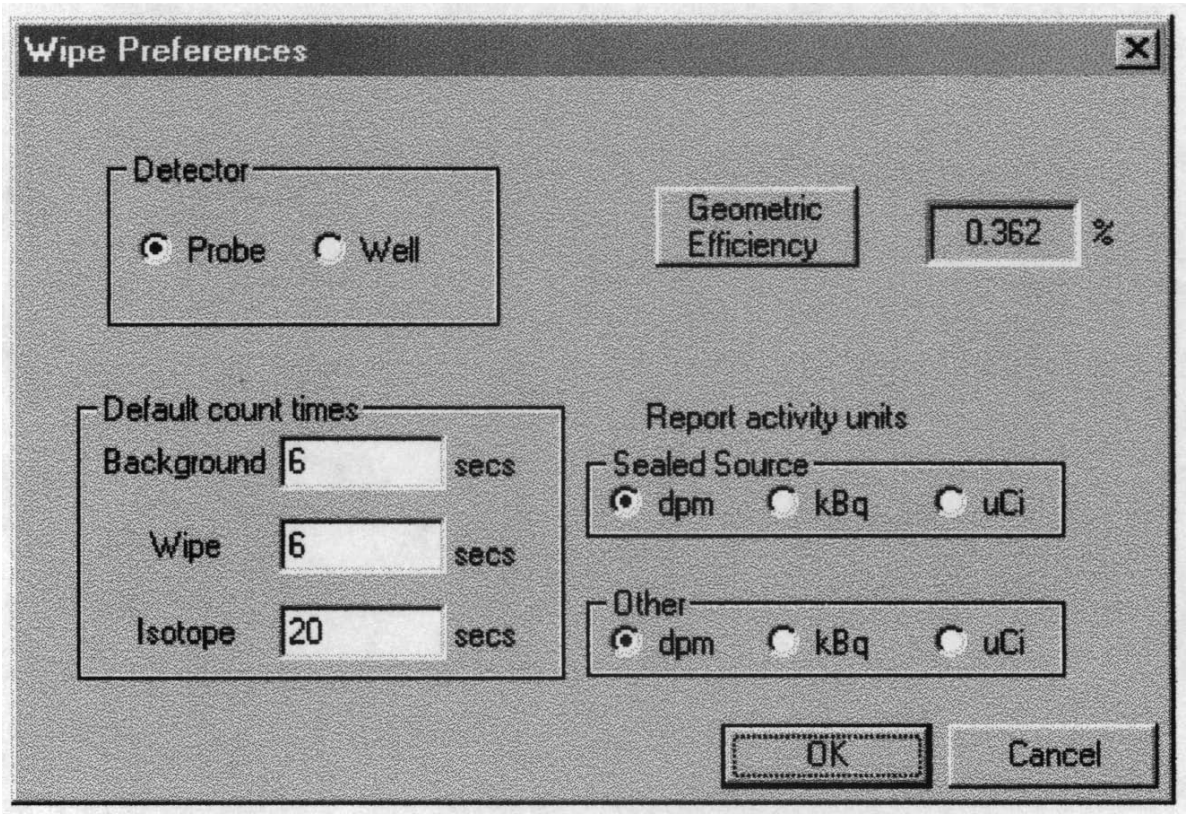


Figure 6-3. The Wipe Preferences Window.

6. In the Available Isotopes list, highlight an isotope and click on <Add to Area>. The isotope name will now be displayed in the lower box. If desired, highlight additional isotopes on the Isotope List and add them to the lower box. To remove an isotope from the box, highlight the isotope in the lower box and click on <Remove From Area>.

7. Set the trigger level.

   NOTE: The trigger level is factory set to 100%. The 100% refers to the NRC trigger levels for different isotopes. If you want tighter control, lower the trigger level. Use the scroll to the right of the trigger level to select a different percentage.

8. Click on <Save> in the screen tool bar to save the new wipe area. The new wipe area should now be shown on the Wipe Area Setup screen.

9. Click on <Close> to return to the Wipe Counting screen with the new area displayed in the Area Name box.

To Delete A Wipe Area

1. To delete an existing Wipe Area, at the Operation screen click on <Wipe>. The Wipe Counting screen should now be displayed.

2. Click on the <Define Wipe Area> icon at the bottom of the screen. The Wipe Area Setup screen should now be displayed.

3. If the currently selected wipe area is the one you want to delete, proceed to step 5. To select another wipe area to delete, click on <Open> in the screen tool bar. The Wipe Area Selection List should now be displayed.

4. Double-Click on the desired wipe area. The selected wipe area should now be displayed on the Wipe Area Setup screen.

5. Click on <Delete> in the screen tool bar.

6. Click on <Yes> to delete.

7. Click on <Close> to return to the Wipe Counting screen. The next wipe area on the Wipe Area Selection List should now be displayed in the Area Name box.

Select Wipe

To Select an Existing Wipe Area

1. To select a wipe area that has already been entered into the system, at the Operation screen click on <Wipe>. The Wipe Counting screen should now be displayed.

2. Click on the <Select Wipe> icon at the bottom of the screen. The Wipe Area Selection list should now be displayed.

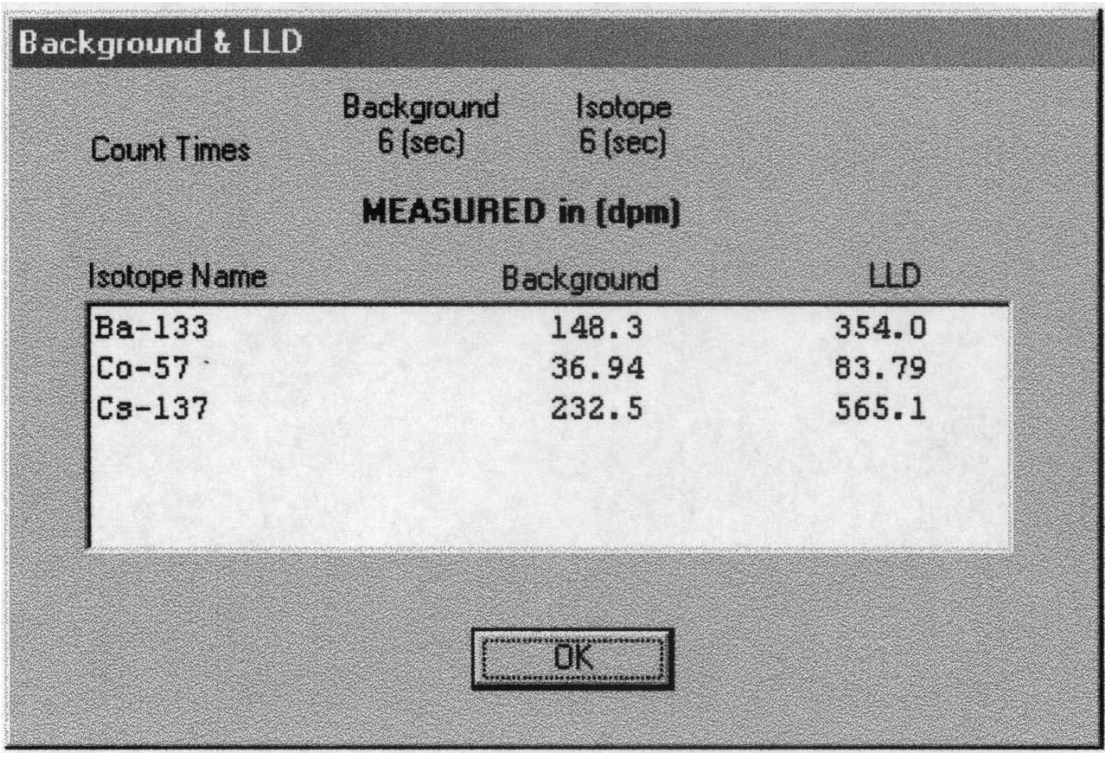


Figure 6-4. The Background LLD Screen.

4. Double-Click on the desired wipe area to select the wipe, or highlight the wipe and click on <Select>. The system returns to the Wipe Counting screen with the selected wipe now displayed in the Wipe Area Name box.

   NOTE: If you click <Close> on the Wipe Area Selection List, the system returns to the Wipe Counting screen with the original wipe still selected.

7. Click on <Close> to return to the Wipe Counting screen. The edited wipe area should now be displayed in the Area Name box.

Wipe Preferences

The Wipe Preferences screen allows the user to specify the detector, default count times for background, wipe and isotope counting, and the geometric efficiency for the detectors. It also allows selection of the report activity units (in dpm, becquerels or microcuries) that will be used for sealed sources or other wipes.

1. From the Operation screen, click on <Wipe>. The Wipe Counting screen should now be displayed.

2. Click on <Preferences> at the bottom of the screen. The Wipe Preferences screen should now be displayed.

3. Select the appropriate detector.

4. Enter default count times for background, wipe and isotope counting.

5. Select the desired report activity units, DPM, kBq or µCi.

6. If you have not already done so, set the Geometric Efficiency as explained in the Administration section of this manual.

7. Once all parameters have been set, click on <Ok> to return to the Wipe Counting screen.

BACKGROUND

Before performing a wipe test, the system must perform a daily background count. The system requires that you count background a minimum of one time per day. If the background changes dramatically in a facility during the day, it is recommended to recount your background at the appropriate intervals.

NOTE: A 60-second background count is recommended. This means that each gain will be counted for 60 seconds.

1. From the Operation screen, click on <Wipe>. The Wipe Counting screen should now be displayed.

   NOTE: If desired, you can at this point click on the <Estimate LLD> icon at the bottom of the screen. This will provide a quick count and estimate of the Lower Limit of Detection (LLD) using the actual counting parameters. By lengthening count times the system will have a better LLD.

2. Click on <Background> at the bottom of the Wipe Counting screen. The Background count will begin automatically. The system will count the gains for all isotopes that have been turned on for wipe testing. If multiple isotopes use the same gain, the system will only count the gain once, using the appropriate regions of interest to calculate the dpms associated with this region for the selected gain. As the system counts, a slidebar at the left of the screen shows the percentage completed. Wipe locations are listed to the right of the slide bar with any results of previous wipes.

Your Hospital Name
Address
City, State Zip
(000) 000-0000

Wipe Results Report

Printed on 02/02/04 08:46

Area: camera rm 1 (Well) Restricted Area, RSO Trigger at 100% of Federal Guidelines

Location: camera — **Time Stamp:** 01/31/03 12:43

>LLD	>Trigger	Isotope	Trigger (dpm)	LLD (dpm)	Background (dpm)	Count Time (sec.)	Net Activity (dpm)
Yes	Yes	I-131	2000	177.2	153.1	10	7796
Yes	Yes	Cs-137	20000	602.5	613.3	10	43159
Yes	No	Co-57	20000	51.4	35.5	10	1755

Location: table — **Time Stamp:** 01/31/03 12:41

>LLD	>Trigger	Isotope	Trigger (dpm)	LLD (dpm)	Background (dpm)	Count Time (sec.)	Net Activity (dpm)
Yes	Yes	I-131	2000	177.2	153.1	10	7301
Yes	No	Cs-137	20000	602.5	613.3	10	3540
No	No	Co-57	20000	51.4	35.5	10	-15

Location: computer — **Time Stamp:** 01/28/03 16:52

>LLD	>Trigger	Isotope	Trigger (dpm)	LLD (dpm)	Background (dpm)	Count Time (sec.)	Net Activity (dpm)
***	***	I-131	*******	*******	*******	****	Not Counted
***	***	Cs-137	*******	*******	*******	****	Not Counted
No	No	Co-57	20000	39.06	31.07	10	-9.921

Location: doorknob — **Time Stamp:** 01/31/03 12:39

>LLD	>Trigger	Isotope	Trigger (dpm)	LLD (dpm)	Background (dpm)	Count Time (sec.)	Net Activity (dpm)
No	No	I-131	2000	177.2	153.1	10	32.2
No	No	Cs-137	20000	602.5	613.3	10	153.5
No	No	Co-57	20000	51.4	35.5	10	4.6

Technologist:
Comments:

Physician: _____ **Date:** _____

Software version 3.36, Unit Serial # 11111

Figure 6-5. The Wipe Results Report.

3. Once the background count is completed, the Background and LLD screen displays the results. Click on <OK> to accept the results and return to the Wipe Counting screen. If the results are not acceptable, click on <Background> again and perform another background.

   NOTE: <Estimate LLD> displays the same style results screen except it notes that the LLD is an estimate, not measured. The estimate LLD counts for ten seconds each.

PERFORMING A WIPE TEST

1. From the Operation screen, click on <Wipe>. The Wipe Counting screen should now be displayed.

2. Click on <Select Wipe Areas> at the bottom of the screen. The Wipe Area Selection list should now be displayed.

3. Double-click on the desired wipe area to select it and return to the Wipe Counting screen.

   NOTE: If you have not yet performed a background count on this date, you must do so before proceeding with the wipe test.

4. Click on the wipe location to be counted. If this wipe has been counted previously the system displays the last count date and time.

5. Click on <Count Wipe> to perform the wipe test. The system now counts for only the isotope listed in this area.

6. Once the wipe test is completed, the results of that wipe location are stored by date and time until that particular wipe is recounted. The screen displays the results, in cpm, next to each isotope in the isotope display window. The last isotope spectrum counted will be displayed at the top of the screen with the ROI cpm shown to the right of the spectrum on the lower part of the screen. To the right of the Isotope Results are listed the net activity, background, lower limit of detection, trigger level and activities. These are shown in either cpm, bq, or microcuries.

To look at the net activity of any isotope, highlight the isotope desired in the Isotope Results window.

NOTE: The <Count Isotope> option is available for use only if an isotope has been highlighted in the Isotope Results window.

If you click on <Count Isotope>, the system will count, for the time frame set under Preferences, only the highlighted isotope. This allows the user to count for a longer period of time, ensuring better accuracy for isotopes with high counts.

SPECTRUM ANALYSIS

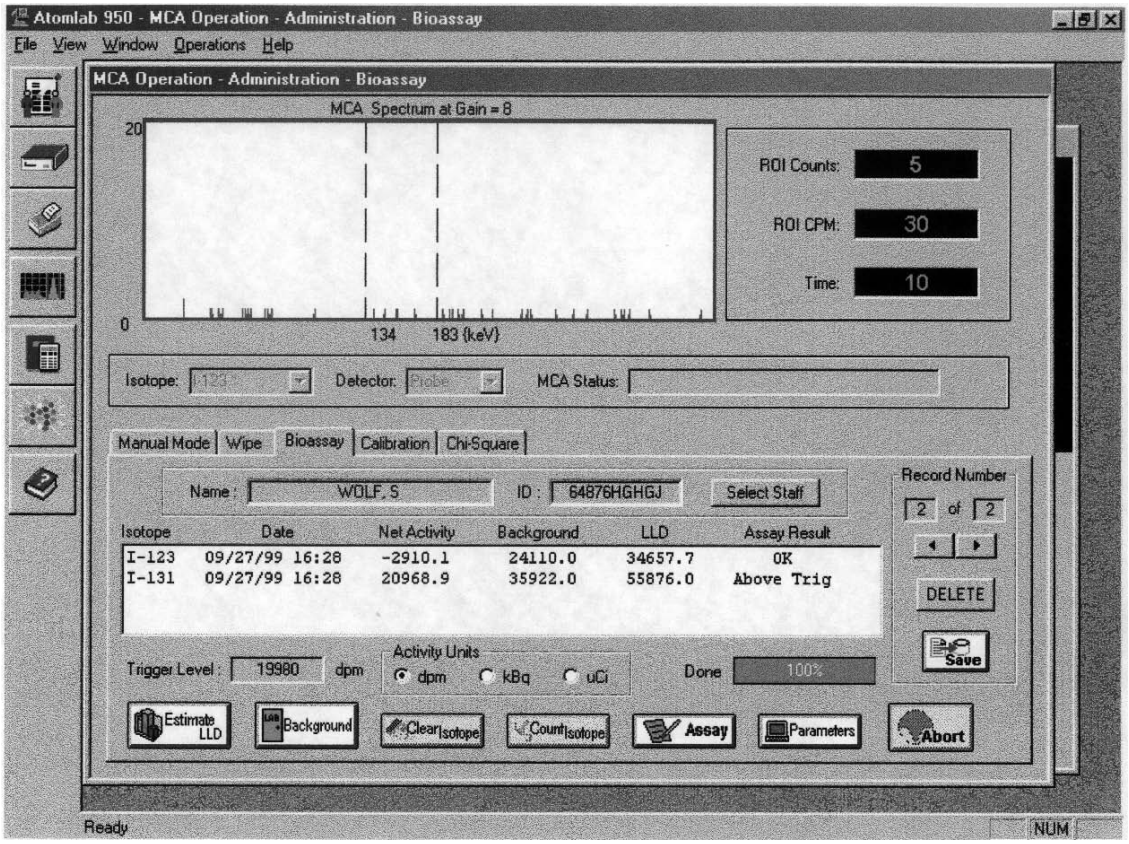
To perform a detailed spectrum analysis, you must count an isotope using the <Count Isotope> icon for a specific wipe. The rest of spectrum analysis functions the same way as described previously in this manual.

7. BIOASSAY

This mode is used to verify any Iodine 131, 123 or 125 concentration for staff or a patient who have direct contact with radioactive iodine or radioactive patients. A record may then be printed out for an individual, as a Bioassay History, or as a Bioassay Employee Summary.

NOTE: In Bioassay and Wipe Test mode, the activity shown is NET activity. This means that the background count is subtracted from the count before the activity is calculated. For all other modes, counts shown are the actual counts detected and are not netted for background.

NOTE: You must use the Isotope Editing screen to make isotopes available for Bioassay use, and the Isotope Efficiencies screen to enter the Detector Efficiency for each isotope. Refer to chapter 3 for details.



7-1. The Bioassay Screen.

To Perform A Bioassay

1. Click on <Patient Definition> in the primary tool bar. Select an existing patient, edit an existing patient, or create a new patient to test. Click on <Close> to return to the Operation screen.

2. Click on <Bioassay>. The Bioassay screen should now be displayed. The selected patient should be displayed in the Select Name box along with the proper patient I.D. number, a listing showing the number of bioassays for this person, and the current bioassay number displayed on the screen. Multiple bioassays can be stored for each patient. Below this is shown the isotope(s), the date counted, net activity, background, lower limit of detection, and assay results. Activity units and Trigger Level are displayed at the bottom of the screen.

3. Click on <Select Staff>. The Staff List should now be displayed. This list includes staff members only. Staff members cannot be counted for any test other than Bioassay. Select the patient by clicking on the staff member and return to the Bioassay screen.

   NOTE: Staff members are entered in the <Patient Definition> window by clicking on the Staff parameter.

4. Click on <Parameters> at the bottom of the Bioassay screen. The Bioassay Preferences screen should now be displayed. Highlight the isotopes you wish to assay in the Available Isotopes Window. Click on <Add> to add the selected isotopes to the Isotopes for Assay window (you must add one isotope at a time.) To remove an isotope from the Isotopes for Assay Window, highlight the desired isotope and click on <Remove>.

5. Select the Detector and Activity Units.

6. Set the appropriate counting times.

7. Set Geometric Efficiency.

8. Set the Trigger Level.

9. After all parameters are set, click on <OK>. The system returns to the Bioassay screen.

   NOTE: If you have not yet performed a background count on this date, you must do so before proceeding with the bioassay. Click on <Background> to count the background. This will count the gain for all isotopes that have been turned on for Bioassay. If multiple isotopes use the same gain, the gain will be counted only once.

10. Click on <Assay> at the bottom of the screen. The system will assay the patient for all isotopes associated with the selected patient.

    NOTE: If you click on <Assay> the system will count for the time frame set under Preferences, all the gains necessary for the isotopes that have been made available for bioassay.

    NOTE: The <Count Isotope> option is available for use only if an isotope has been highlighted in the Isotope Results window. If you click on <Count Isotope>, the system will count, for the time frame set under Preferences, only the highlighted isotope. This allows the user to count for a longer period of time, ensuring better accuracy for isotopes with high counts.

11. To print a Bioassay Report, click on the <Report> icon in the primary tool bar. You can then select from Individual Bioassay Report, Individual Bioassay History Summary, or Employee Bioassay Summary.

12. If you want to change the contamination trigger level, double-click in the box and enter the new contamination value.

    NOTE: If you change the trigger level, the new amount is used for all new tests.

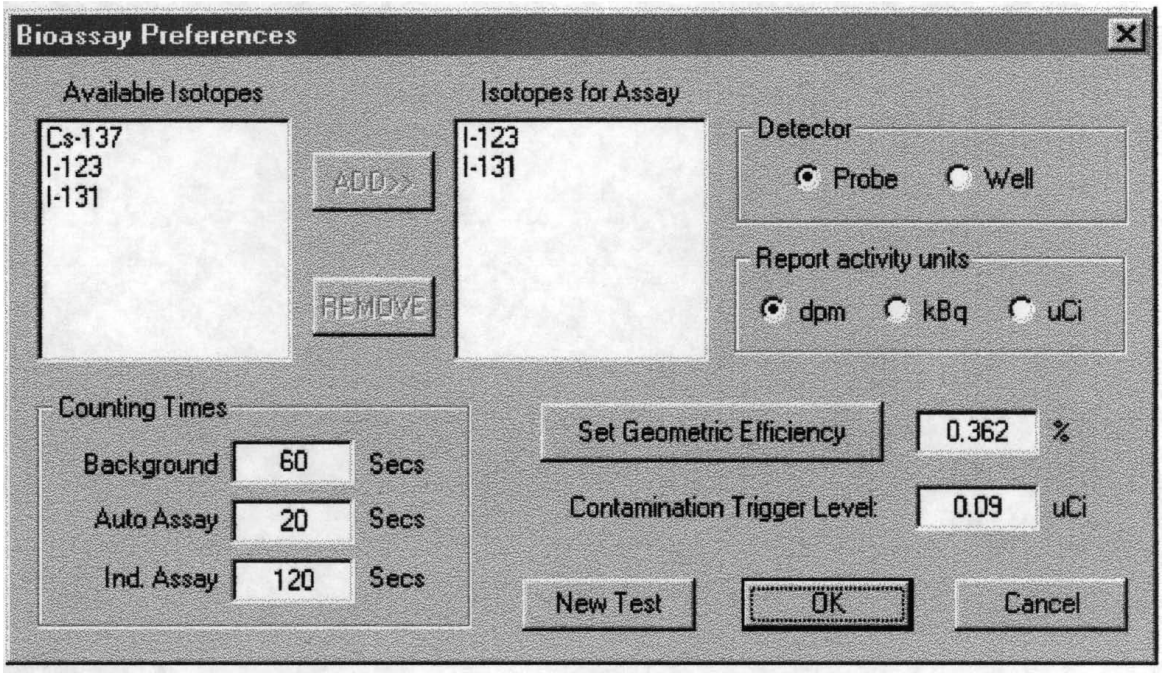


Figure 7-2. The Bioassay Preferences Screen.

13. After assaying a patient or staff member and accepting the count, press <Save> to save the information..

    NOTE: When you wish to perform an additional assay for this patient, click on <Parameters> and then click on <New Test>.

15. If you click on the arrows under the record number, you can see the record number increase or decrease and display the appropriate results for each test.

    NOTE: In order to count a patient in Bioassay, you must select that patient in the <Patient Definition> window. Select an existing procedure for the patient, then click on Bioassay to display that patient and any test data. The Bioassay information is not listed as a test, having been performed in the <Patient Definition> window. To add a Bioassay record to the patient, click on <Parameters> and then click on <New Test>.

Your Hospital Name
Address
City, State Zip
(000) 000-0000

Individual Bioassay Report

Printed on 02/02/04 08:43

Name: Jessica Johnson **ID:** 9874587

Date: 03/07/03 10:12

Isotope	Net Activity (dpm)	Background (dpm)	LLD (dpm)	Trigger (dpm)	Assay Results
I-131	402.3	20264	18319	19980	OK

Technologist:
Comments:

Physician: _____ **Date:** _____

Software version 3.36, Unit Serial # 11111

Figure 7-3. An Individual Bioassay Report.

Your Hospital Name
Address
City, State Zip
(000) 000-0000

Individual Bioassay History Summary

Printed on 06/07/04 12:05

Name: samantha Febuary **ID:** 2-21-03

Date: 06/07/04 12:01

Isotope	Net Activity (dpm)	Background (dpm)	LLD (dpm)	Trigger (dpm)	Assay Results
I-131	156880	44500.7	45462.1	19980.0	Above LLD/Trg

Date: 05/26/04 11:53

Isotope	Net Activity (dpm)	Background (dpm)	LLD (dpm)	Trigger (dpm)	Assay Results
I-131	-20526.7	44500.7	45462.1	19980.0	OK

Date: 05/07/04 11:52

Isotope	Net Activity (dpm)	Background (dpm)	LLD (dpm)	Trigger (dpm)	Assay Results
I-131	-20526.7	44500.7	45462.1	19980.0	OK

Technologist:
Comments:

Physician: _____ **Date:** _____

Software version 3.36, Unit Serial # 999999

Figure 7-4. An Employee Bioassay Summary.

Your Hospital Name
Address
City, State Zip
(000) 000-0000

Employee Bioassay Summary

Printed on 02/02/04 08:43

Name: tueula bing **ID:** oidf96kj **Date:** 03/07/03 10:00

Isotope	Net Activity (dpm)	Background (dpm)	LLD (dpm)	Trigger (dpm)	Assay Results
Cs-137 cus	19844	61337	50748	19980	OK
I-131	402	20264	18319	19980	OK

Name: Jessica Johnson **ID:** 9874587 **Date:** 03/07/03 10:12

Isotope	Net Activity (dpm)	Background (dpm)	LLD (dpm)	Trigger (dpm)	Assay Results
I-131	402.3	20264	18319	19980	OK

Technologist:
Comments:

Signature: _____ **Date :** _____

Software version 3.36, Unit Serial # 11111

Figure 7-5. An Individual Bioassay History Summary.

8. SCHILLING TESTS

In this mode, Schilling tests using the standard commercial kits Mallinckrodt - Bracco and Dicopac have been programmed into the system. Before use, the operator should go to the Procedure Definition Window, select the kit style used in the facility, and set-up or verify that the counting time, correction factor and sample volumes are correct for the procedure.

For the Schilling Kits, the manufacturers recommend using a 4-ml sample volume with a correction factor of 100 and a counting time of 600 seconds. This means that the standard, the sample and lab background will all be counted for 600 seconds each (the correction factor deals with the standard). When the correct parameters have been input into the kit procedure window, click on <Close>.

To Define a Facility Standard Schilling Test

(See Figure 8-1.)

To set up for the standard procedure used in your facility, it is helpful to set up a global facility standard schilling test as described below.

1. Click on <Procedure Definition> in the primary tool bar. The procedure definition screen should now be displayed.
2. Click on <Add>.
3. Enter the procedure name in the procedure name box.
4. Select the appropriate detector.
5. Select the Schillings Kit that you wish to use.
6. Enter the counting time.
7. Enter the proper correction factor.
8. Enter the sample volume to be counted.
9. Click <Save> to save the information.

NOTE: To change any information, click on <Open>. Select the appropriate type of procedure, whether it is Thyroid Uptake, Schillings, or Hematology,and then select the appropriate study style under that procedure. If you double click on the procedure, it will go to the procedure definition screen highlighting that particular procedure. If you wish to enter a new procedure, follow the above procedure definition by clicking on <Add> and entering all the appropriate information If you wish to just edit the procedure, click <Edit> and you can make any changes to the procedure that you desire. It is recommended to add procedures to the list and delete the existing one if desired.

To Perform A Schillings Test (Bracco, Mallinckrodt or Simple Mallinckrodt)

(See Figure 8-2.)

1. At the Patient Definition screen, choose an existing patient or enter a new patient.
2. Highlight the appropriate Schilling procedure to add this procedure to the selected patient. Once you choose the procedure (i.e: Bracco Schilling Kit) click on <Select>. The Schilling counting page should now be displayed.

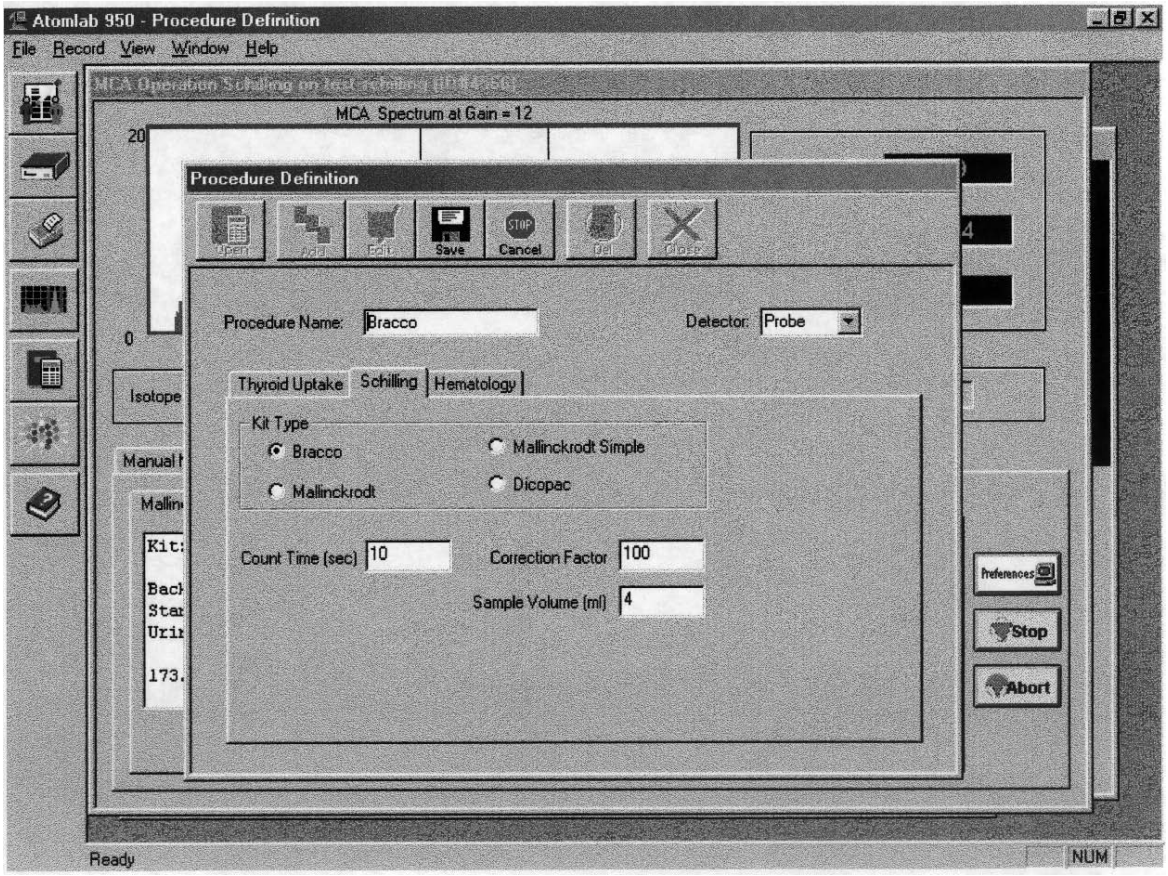


Figure 8-1. Defining a Facility Standard Schilling Test.

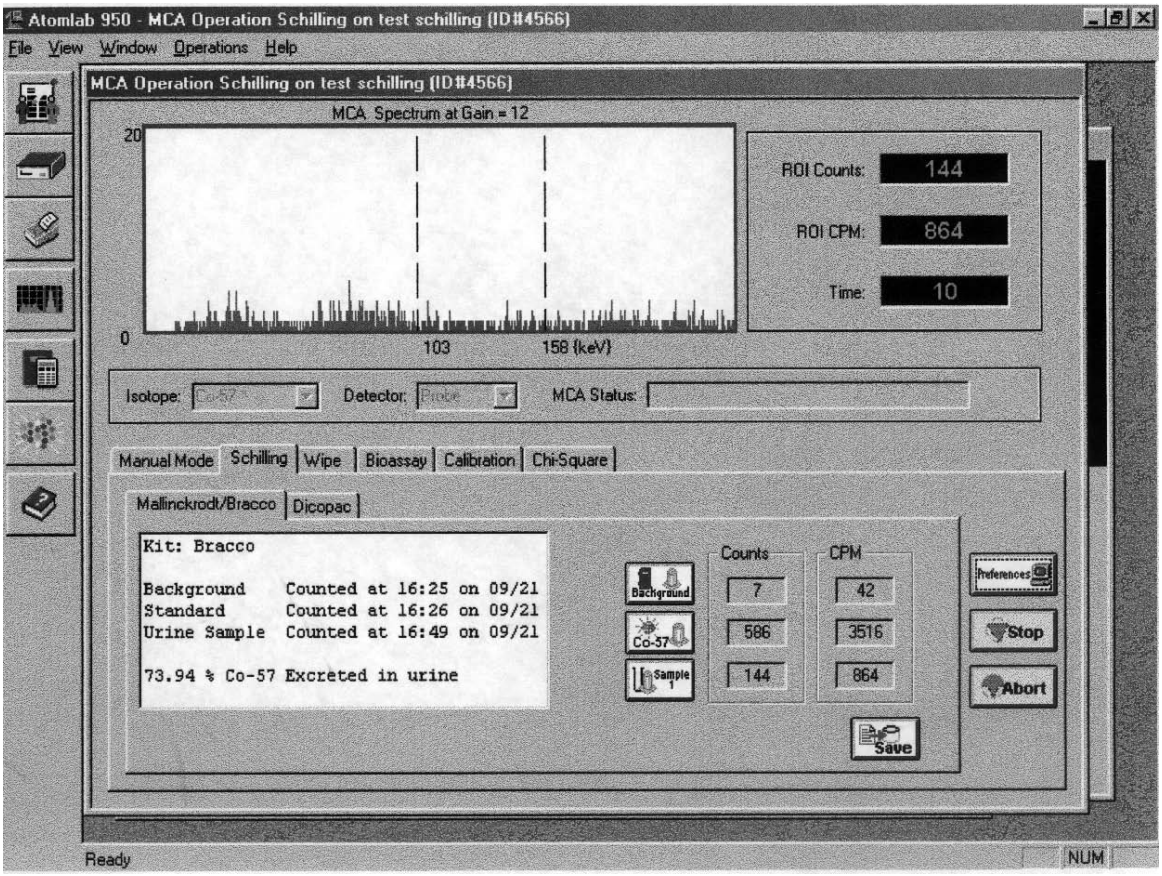
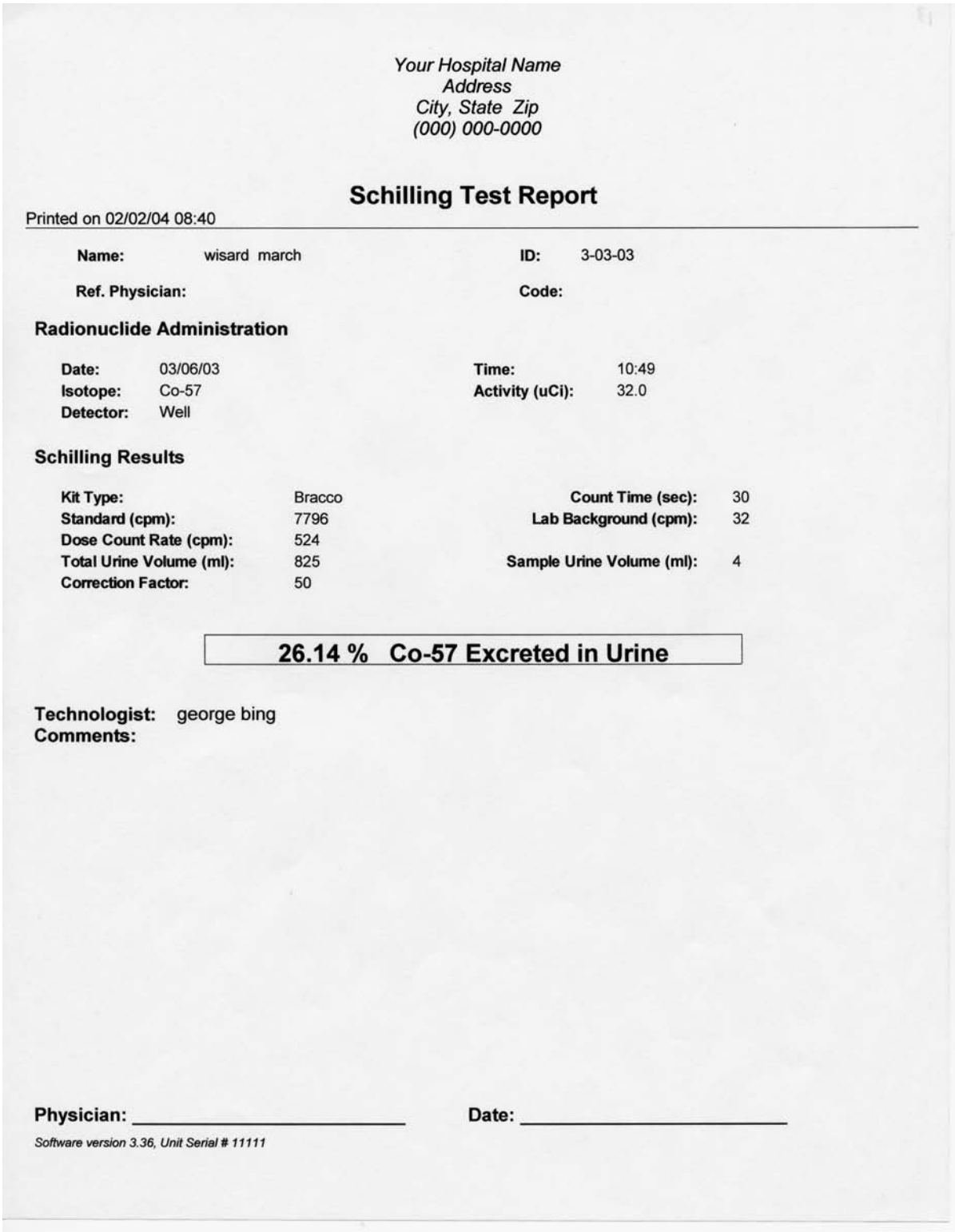


Figure 8-2. The Schillings Counting Page.



Your Hospital Name
Address
City, State Zip
(000) 000-0000

Schilling Test Report

Printed on 02/02/04 08:40

Name: wisard march **ID:** 3-03-03

Ref. Physician: **Code:**

Radionuclide Administration

Date: 03/06/03 **Time:** 10:49
Isotope: Co-57 **Activity (uCi):** 32.0
Detector: Well

Schilling Results

Kit Type:	Bracco	**Count Time (sec):**	30
Standard (cpm):	7796	**Lab Background (cpm):**	32
Dose Count Rate (cpm):	524		
Total Urine Volume (ml):	825	**Sample Urine Volume (ml):**	4
Correction Factor:	50		

26.14 % Co-57 Excreted in Urine

Technologist: george bing
Comments:

Physician: _____ **Date:** _____

Software version 3.36, Unit Serial # 11111

Figure 8-3. A sample Schillings Mallinckrodt Report.

3. Click on the <Preferences> button and then enter a total urine volume for the patient that you are testing.

4. Once you have entered the total volume, click <OK>. You can now proceed with counting.

   NOTE: You can change the sample volume, correction factor and count time for this study in the parameters window.

   NOTE: If you use a different standard volume or concentration, you must change the correction factor.

5. Click on the background button and the system will proceed to count lab background. When it is done counting, the number of counts and the counts per minute will both be displayed.

6. Remove the background vial and insert the Co-57 standard into the well.

7. Click on the highlighted <Co-57> standard button. The system will now count the Co-57 standard. When counting is finished, the total counts and the counts per minute will be displayed. The <Sample> button should now be displayed.

8. Remove the Co-57 standard from the well and place the urine sample into the well.

9. Click on <Sample> to begin counting the urine sample. When counting is finished, the total counts and counts per minute will be displayed.

10. When the system has completed the count, a window will be displayed asking to verify that the test is complete. To save the results, click <Yes>. If you do not wish to Save, click <No> and you can then proceed to recount any one of the three items counted.

    NOTE: If an error was made in the total urine volume, do not click <Save>. You can go back and click on <Preferences> to correct the error as long as you have not saved.

11. Once you have finished with any recounts for this patient, select <Save> to display the "Verify Test Complete" screen. If the numbers are satisfactory, click <Yes> to save the results.

12. To print results at any time, click on the <Print> icon. This will open the report generation screen from which you can choose a technologist to add to your study.

13. To enter and store the dose activity associated with this patient, press <Preview> for a preview of the report. Press <Print> to print the report.

    NOTE: Make sure to save before leaving the patient and going on to do other tests or studies with your spectrometer.

    NOTE: The Bracco and Mallinckrodt kits use the same procedure. You can modify the sample volumes, but then you must correct and enter the appropriate sample volume in milliliters in the Preferences window.

Schilling Test for the Simplified Mallinckrodt Procedure

(See Figure 8-3.)

This is the same as the Mallinckrodt and Bracco procedures except that you cannot enter a sample volume in the Preferences window. For this test, you must use a 4ml volume in order for the system to calculate correctly.

Schilling Dicopac

(See Figures 8-4 and 8-5.)

The Dicopac Schillings procedure is programmed to use the Mediphysics/Amersham Dicopac Schilling Test Kit. The counting procedures and formulas for calculations are all from the manufacturer's Dicopac Kit instructions.

To Perform a Dicopac Schillings Test:
(See Figure 8-4.)

1. Click on the <Procedure> icon to access the Procedure Definition window.

2. At the Procedure Definition window, enter the parameters for the Dicopac studies that you wish to perform. You can modify an existing procedure or create a new procedure. This entails entering the counting time, sample volume, detector and type of kit.

   NOTE: Once you do enter and save, this procedure is now stored and you do not have to enter it again.

3. Enter the patient, if not entered in the patient window, or select the patient if already in the system, and pick the proper Schillings Test to perform for this patient.

4. At the Schilling Dicopac screen, verify that the patient name and ID is correct.

5. Click on <Preferences> to open the Dicopac parameters window.

6. Verify that the counting time and sample volumes are correct. The standard in the Dicopac Kit is 600 seconds counting time and a sample volume of 4ml.

7. Enter the total urine volume collected by the patient over the 24 hour collection period and click <OK>.

8. Ensure the vials, samples and standards are ready and proceed with the test.

9. Take an empty vial and add water to it to the same volume that you are using for your urine aliquot. Place this vial into the well counter.

10. Click <Background>. The system automatically counts background for both Co-57w and Co-58w.

11. Remove the tube used for background counting and place the Co-58 standard into the well counter.

12. Click on the < Co-58> standard button. The system will now count the Co-58 standard and record the count in the Co-58w window. The system next automatically counts the Co-57w window, using the Co-58 source to calculate spill-down.

    NOTE: For spill-down, the system periodically pauses to record the current data, then continues counting from 0 counts (the time between data downloads varies depending on the count rate). New data is added to previous data until the total counting time requested is completed. This prevents roll-over from occurring. The total counts for spill-down are recorded as the final Co-57 spill-down result.

13. Remove the Co-58 standard from the well counter.

14. Place the Co-57 standard into the well counter.

15. Click <Co-57>to count the Co-57 standard and store the value. When done counting, remove the Co-57 standard from the well counter.

16. Place the urine aliquot or sample into the well counter.

17. Click on <Sample> to count the urine sample for both the Co-58w and Co-57w windows.

18. When counting, is complete, the "Verified Test Complete" window is displayed. At this point, the system displays the calculations for Co-57, Co-58 and the percentage excretion in the lower left corner of the screen. If you wish to save, click <Yes>. The system will automatically save the data.

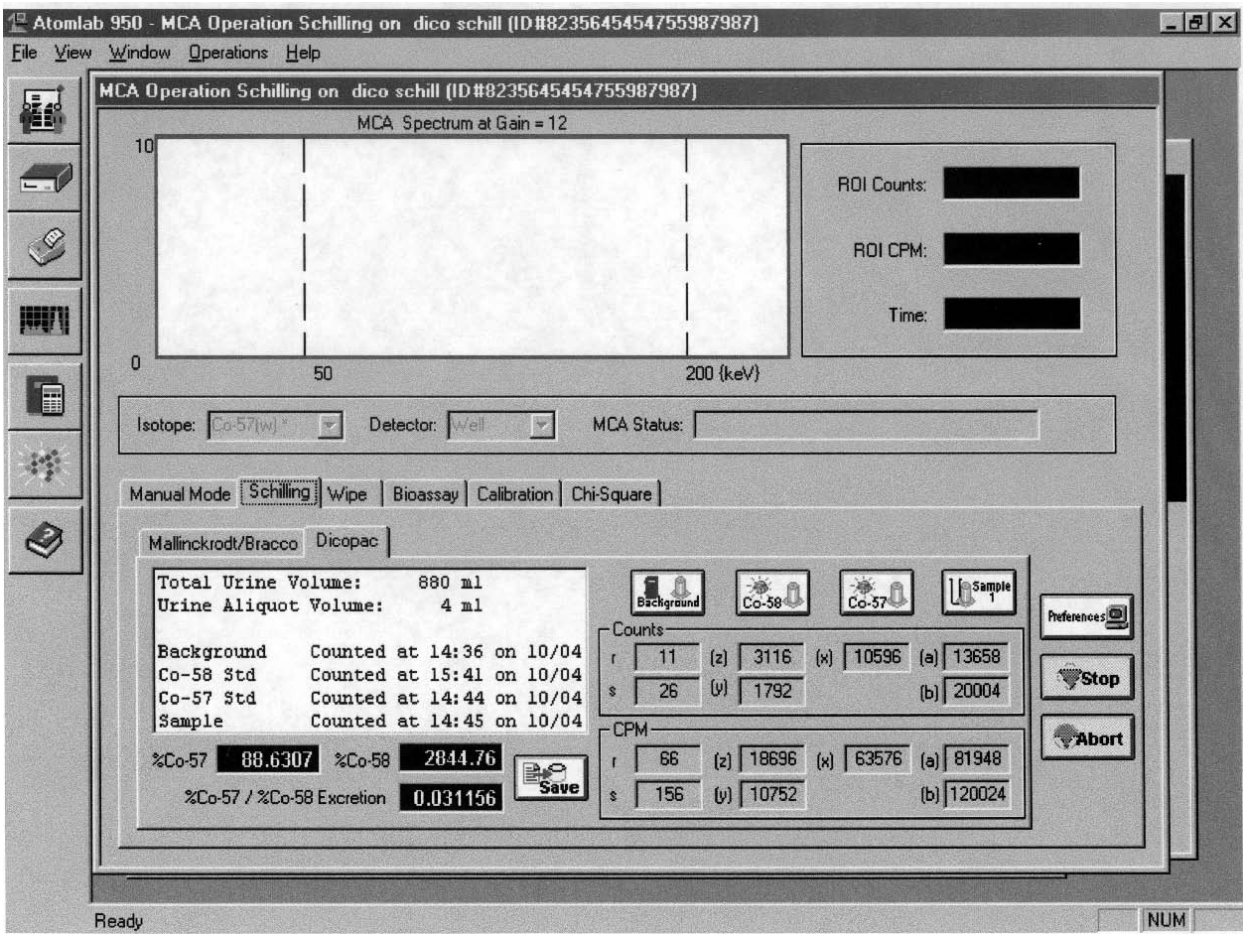


Figure 8-4. The Diopac Schillings Counting Page.

Your Hospital Name
Address
City, State Zip
(000) 000-0000

Dicopac Test Report

Printed on 02/02/04 08:41

Name: wisard march **ID:** 3-03-03

Ref. Physician: **Code:**

Dicopac Lot #: _____ **Administered:** _____

Total Urine Volume: 935 **ml** _____ **Hour Collection**

Urine Aliquot Counted: 4 **ml**

ALIQUOT CORRECTION FACTOR = $\frac{\text{Total Urine Volume}}{\text{Urine Aliquot Counted}}$ = U = 233.8

Count Values in CPM

1. Co57 Setting Background.	r =	129	11. Net urine Co57 counts.	(a) - r = a =	3540
2. Co58 Setting Background.	s =	102	12. Urine aliquot at Co58 settings.	(b) =	4137
3. Co58 STD at Co58 Settings	(z) =	41535	13. Net urine Co58 counts.	(b) - s = b =	4035
4. Net Co58 STD	(z) - s = z =	41433	14. Urine aliquot Co58 "spill down" into the Co57 settings.	b x f = SD =	2795
5. Co58 at Co57 settings	(y) =	28833			
6. Net Co58 at Co57 settings	(y) - r = y =	28704	15. Co57 urine aliquot counts corrected for "spill down".	a - SD = c =	744.6
7. Co57 STD at Co57 settings	(x) =	82953	16. Calculate the % excretion Co57	2 x U x c/x =	**4.203**
8. Net Co57 STD	(x) - r = x =	82824			
9. "Spill-down" factor of Co58 at Co57 settings	y / z = f =	0.6928	17. Calculate the % excretion Co58.	2 x U x b/z =	**45.53**
10. Urine Aliquot at Co57 settings	(a) =	3669	18. Calculate the excretion ratio.	Co57%/Co58% =	**0.0923**

Co57 / Co58 Excreted Ratio = 0.0923

Technologist: george bing
Comments:

Physician: _____ **Date:** _____

Software version 3.36, Unit Serial # 11111

Figure 8-5. A Sample Diopac Schillings Report.

9. HEMATOLOGY

In the Hematology Mode there are a number of different programs that can be used. All are based on commercially available kits. The programs include IHSA I-125, Cr-51 Blood Volume, Cr-51 Red Cell Survival, Glomerular Filtration Rate (GFR) and Effective Renal Plasma Flow (ERPF).

The Hematology Patient Page

(See Figure 8-1.)

Setting Up For Hematology

1. To set up for any of the hematology procedures, click on the <Procedure Definition> icon in the primary tool bar to select the Procedure Definition window.

2. Open the procedure list and correct or change any parameters for any procedure or create a new procedure with the requirements for your studies.

   NOTE: Once you have created the standard procedure for this study, you do not have to go back to this window and modify it. It will be stored and usable for any future patient studies of this type.

3. Click on the <Patient Definition> icon in the primary tool bar. The Patient Definition window should now be displayed. For an existing patient, simply add the new procedure. For a new patient, add the patient and the procedure.

   NOTE: We recommended creation of a new procedure rather than modification of an existing procedure.

4. Once a patient is in the system and the appropriate hematology method is listed for that patient, select that patient and proceed to the Hematology Counting page. You can now proceed to the appropriate test as described below.

IHSA I-125

(See Figure 9-1 and 9-2.)

To perform an IHSA I-125 study, follow the kit instructions for preparing and administering the dose. When preparing to count the different parts of the study, be sure to have all the vials set up so they can be counted one after the other to negate any decay factors.

1. To start the study, verify that the correct patient and patient ID# is listed at the top of the Hematology Counting page.

2. Click on <Preferences> at the right side of the screen and verify the volumes and dosage used. Correct the count time if desired. After reviewing the window and parameters, click <OK>.

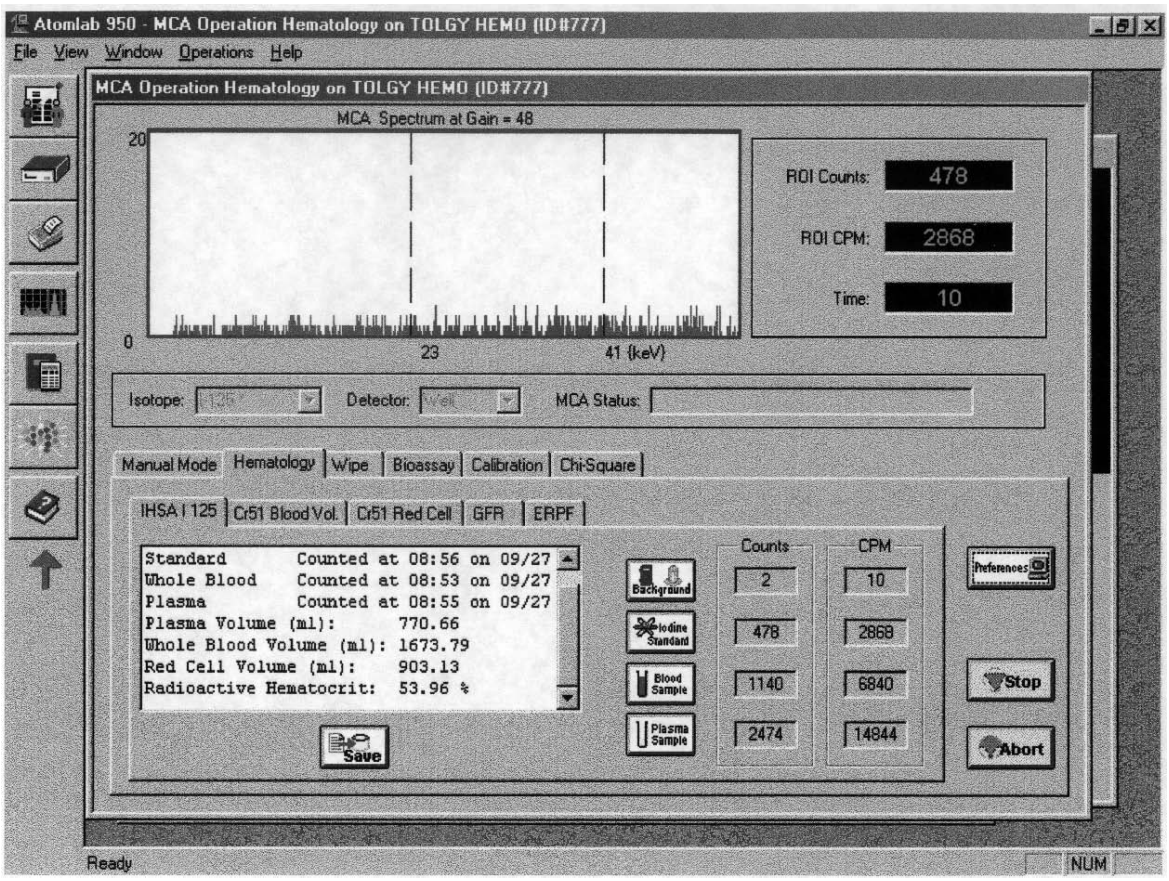
3. Click on <Background> to perform a background count for the I-125 window. When done counting, the system will display the counts and CPM. The <Iodine Standard> button should now be highlighted.

4. Remove the vial that was used for counting background and place the vial with the iodine standard into the well counter. Click on <Iodine Standard> to count the standard. When done counting the system will display the counts and the counts per minute.

5. Remove the vial with the iodine standard and place the blood sample vial into the well counter.

6. Click on <Blood Sample> to begin counting the blood sample. When done counting, the system displays the counts and CPM for the blood sample.

7. Remove the blood sample vial from the well counter and put the plasma sample vial into the well counter.



9-1. The IHSA Counting Page.

8. Click on <Plasma Sample> to begin counting the plasma sample. When done counting, the system displays the plasma sample counts and count rate.

9. When it is done counting the plasma sample, the system will display the "Verified Test Complete" window, asking if you want to permanently save the data. In the lower left corner of the screen you can see the calculations and results for the volumes and radioactive hematocrit percent number. To accept the numbers that were taken, click <Yes> to save the data. If you wish to recount any of the items, click <No>.

10. If you are satisfied with the results, click <Yes> on the "Verified Test Complete" screen (if this screen is not displayed, click on <Save> to bring up the screen, then click <Yes> to save before moving onto any other patients or functions.

    NOTE: Once you have saved, you cannot make any other changes to this particular study for this patient.

    NOTE: If you wish to print a report, click on the <Printer> icon in the primary tool bar and then print the appropriate hematology report. You can add a technologist and a dose activity to the report, if desired.

Cr-51 Blood Volume

(See Figure 9-3.)

To perform a Cr-51 blood volume test, prepare all your samples and label them according to the manufacturer's kit instructions. When you are ready to count, you must first enter a patient into the patient database and choose the Cr-51 blood volume test for that patient. If the patient is already in the system, add a new test of the Cr-51 blood volume as a new procedure for this patient.

A one-time set up for the Cr-51 test would be to go to the procedure window and enter the count time that you will use for each of the items into the procedure definition. Once this time is set and you save it, all Cr-51 blood volume tests will use this counting time, unless adjusted.

1. At the Cr-51 blood volume counting page, verify that the patient Name and patient's ID# at the top of the screen are correct.

2. Click on <Preferences> and enter the patient hematocrit number as a percentage. Also enter the Red Blood Cell (RBC) suspension hematocrit as a percentage. If needed, adjust the counting time in this window and then press <OK> to proceed.

3. Place the vial that will be used for counting background into the well counter and click on <Background>. The system will now count for background. When counting is completed, the counts and counts per minute will be displayed.

4. Remove the background vial from the well and insert the vial with the blood standard into the well counter. Click on <Blood Standard> count the standard. When counting is completed, the counts and counts per minute will be displayed.

5. Remove the blood standard vial from the well counter and insert the plasma standard vial into the well counter. Click <Plasma Standard> to count the plasma standard. When counting is completed, the counts and counts per minute for the plasma standard will be displayed.

6. Remove the plasma standard vial from the well counter and put the blood sample vial into the well counter. Click on <Blood Sample> to count the blood sample. When counting is completed, the counts and counts per minute for the blood sample will be displayed.

7. Remove the blood sample vial from the well counter and place the plasma sample vial into the well counter. Click on <Plasma Sample> to count the plasma sample. When counting is completed, the counts and counts per minute for the plasma sample will be displayed.

Your Hospital Name
Address
City, State Zip
(000) 000-0000

IHSA I-125 Test Report

Printed on 02/02/04 08:38

Name: samantha Febuary **ID:** 2-21-03

Ref. Physician: **Code:**

Radionuclide Administration

Date:	02/22/03	**Time:**	09:46
Isotope:	I-125	**Activity (uCi):**	231.0
Detector:	Well		

IHSA I-125 Results

Standard Count (cpm):	633	**Lab Background Count (cpm):**	6
Whole Blood Count (cpm):	2124	**Plasma Count (cpm):**	6243

Plasma Volume (ml):	402.12	**Red Cell Volume (ml):**	782.02
Whole Blood Volume (ml):	1184.14	**Radioactive Hematocrit:**	66.04 %

Technologist: Sharon Johnson
Comments:

Physician: _____ **Date:** _____

Software version 3.36, Unit Serial # 11111

Figure 9-2. A Sample IHSA I-125 Test Report.

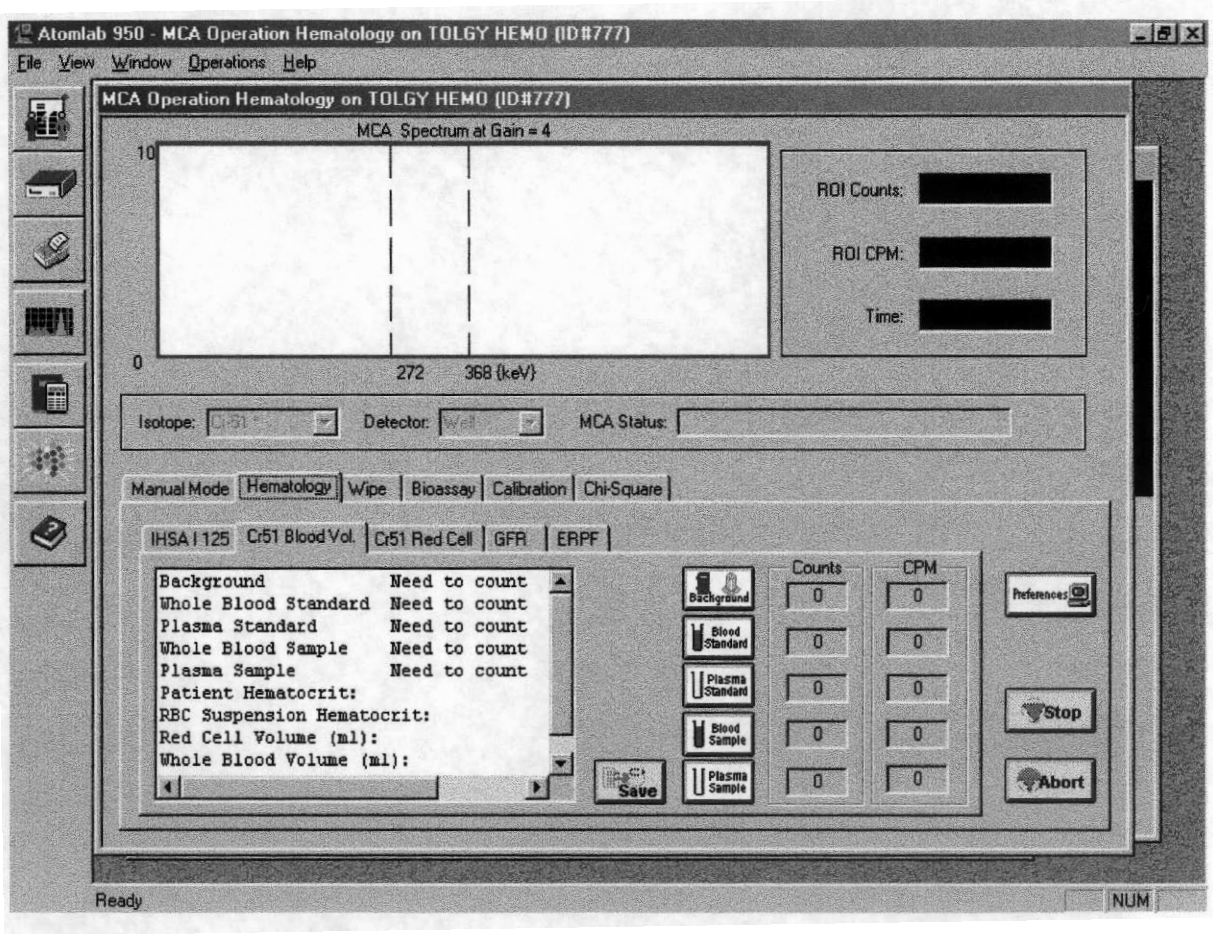


Figure 9-3. The CR-51 Counting Page.

8. When it is done counting the plasma sample, the system will display the "Verified Test Complete" window, advising that the test is complete and you can now permanently save the results in the database. If you are satisfied with the results and the tests, click <Yes> to permanently save. If you wish to recount any one of the items, click <No>.

9. If you have clicked <No>, you can now place the appropriate vial into the well and press the corresponding button to recount that vial. When the system is done it will display the "Verified Test Complete" window again and you can save or not save at that point.

   NOTE: If you did not save and you are looking at the Cr-51 main screen, you can save by pressing the <Save> button, which will display the <Verified Test Complete> screen. Then click <Yes> and the study will be permanently saved. You can now proceed to count another patient or do another procedure.

Your Hospital Name
Address
City, State Zip
(000) 000-0000

Cr-51 Volume Test Report

Printed on 06/07/04 10:57

Name: samantha Febuary **ID:** 2-21-03

Ref. Physician: Dr.Twing **Code:**

Radionuclide Administration

Date:	02/22/03	**Time:**	09:12
Isotope:	Cr-51	**Activity (uCi):**	_____
Detector:	Well		

Cr51 Blood Volume Results

Whole Blood Standard Count (cpm):	6258	**Plasma Standard Count (cpm):**	1248
Whole Blood Sample Count (cpm):	22218	**Plasma Sample Count (cpm):**	939
Lab Background Count (cpm):	30		
Patient Hematocrit (%):	38.00	**RBC Hematocrit (%):**	40.00

Red Cell Volume (ml):	**96.60**
Whole Blood Volume (ml):	**254.21**
Plasma Volume (ml):	**157.61**

Technologist: doris smithee
Comments:

Physician: _____ **Date:** _____

Software version 3.36, Unit Serial # 999999

Figure 9-4. A Sample Cr-51 Volume Test Report.

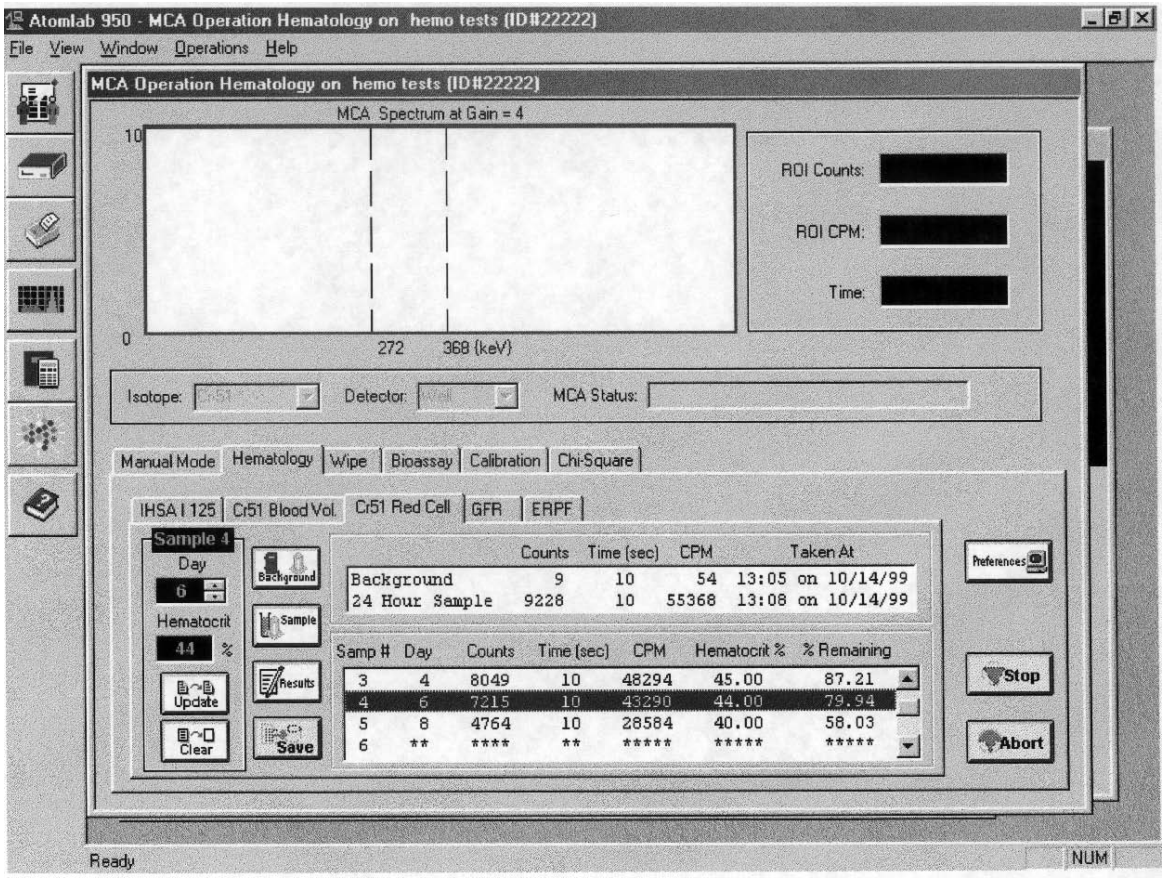


Figure 9-5. The Cr-51 Red Blood Cell Survival Counting Page.

Cr-51 Red Cell Survival

(See Figures 9-5 and 9-6.)

To set up as the standard number of samples and the count time, click on the <Procedure Definition> icon in the primary tool bar and then enter the red cell survival maximum number of samples and counting time. Once set, these will be the default values for each new study performed.

NOTE: This information in <Procedure Definition> can be set-up anytime for all procedures before counting any patients. These are your default counting parameters.

The Cr-51 Red Cell Survival test follows the procedures from the published Mallinckrodt Red Cell Survival Test Kit. In order to perform this test, assemble all the blood samples, appropriate hematocrits, the standard, and a background vial to count. When entering the data for this test, enter the hematocrit that is associated with each sample number as well as entering the day the sample was drawn (i.e., sample drawn after 72 hours is Day 3.) Since the Red Cell Survival Test stretches over many days, there can be days skipped between when samples are drawn.

To perform a Red Cell Survival Test:

1. Either enter a new patient and pick the Red Cell Survival procedure for this patient, or go to the Patient Window, select the existing patient and add the Red Cell Survival as a new test for this patient. Once the patient has been set up for the Red Cell Survival, proceed to the counting screen for this patient.

2. At the counting screen, verify that the correct patient and ID# are on the page.

3. Click on <Preferences>. In the preferences window is displayed the counting time and the number of samples to be counted. You can correct the number of samples and increase or decrease the numbers as desired. Once you have set the count time and the number of samples, click <OK>. You can now proceed to count.

4. Put the background vial into the well counter and click <Background>. The system will count the background for the pre-determined time. When done, the counts per minute and the counting time, plus the time/date that background was counted will be displayed.

5. After background is counted, the system will highlight the 24 hour sample. Remove the background vial from the well counter and place the vial with the 24 hour sample into the well counter.

6. On the left side of the page is displayed Sample #1, Day #1 and hematocrit as 0%. Enter a value for hematocrit by first double clicking on the box and then typing in the correct value for Sample #1 Hematocrit.

7. Click on <Sample> to count the 24 hour blood sample. When done counting, the system will display and enter the counts, counting time and hematocrit into the chart.

8. When it is finished counting, the system will proceed to Sample #2. Remove Sample #1 and put Sample #2 into the well counter.

9. On the left side of the screen is displayed Sample #. Below that, the day is listed as zero and hematocrit is listed as zero. Using the <UP/DOWN Arrows>, set the day to match the day on which the sample was drawn. Enter the hematocrit number by first double clicking on the box and then entering the appropriate hematocrit. When you are done entering hematocrit as a percentage, click on <Sample>. The system will now count Sample #2. When it is done counting, the results will be displayed.

10. The system will now advance to the third sample and display Sample #3 on the left side of the screen. Using the <UP/DOWN Arrows>, enter the day the sample was drawn. Now enter the hematocrit value by double clicking on the box and then entering the hematocrit as a percentage.

Your Hospital Name
Address
City, State Zip
(000) 000-0000

Cr-51 Survival Test Report

Printed on 02/02/04 08:41

Name: samantha Febuary **ID:** 2-21-03

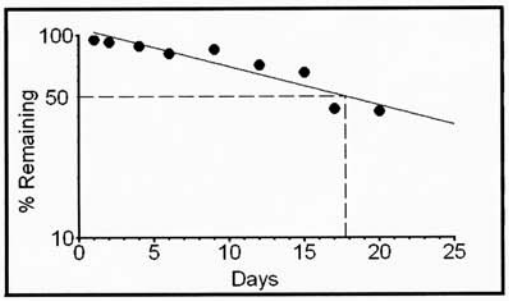
Ref. Physician: **Code:**

Radionuclide Administration

Date: _____ **Time:** _____

Isotope: Cr-51 **Activity (uCi):** _____

Detector: Well



# of Samples: 9
Count Time (sec): 20
Background (cpm): 30

RBC Survival (Days): **17.7**

Normal: 28 to 40 days
Abnormal: Less than 28 days

Day	cpm	Hct. (%)	% Rem.
1	27699	45.00	100.00
2	25620	45.00	92.49
4	23448	43.00	88.57
6	22044	44.00	81.37
9	21537	41.00	85.31
12	16638	38.00	71.08
15	14061	35.00	65.20
17	9894	37.00	43.36
20	8313	32.00	42.10

Technologist:
Comments:

Physician: _____ **Date:** _____

Software version 3.36, Unit Serial # 11111

Figure 9-6. A sample Cr-51 Survival Test Report.

GFR

(See Figure 9-7.)

The following test is for the Glomerular Filtration Rate (GFR) test. This test uses Technetium-99m - DTPA as the pharmaceutical. The GFR test is a renal function test of the kidneys. The procedure followed is from the Journal of Nuclear Medicine Technology, Volume 14, Number 4, December 1986, entitled, "Technical Aspects of a New Technique for Estimating Glomerular Filtration Rate Using Technetium-99m - DTPA" by Kathrine R. Rowell, Frances N. Kontzen, Marian E. Stutzman, et al., V.A. Medical Center and University of Alabama, Birmingham, Alabama. The program can have either one or two samples used in the calculation.

Both the one and two sample methods follow the package inserts for Technetium DTPA for production of the pharmaceutical. Look at the HELP SECTION for the Medical Spectrometer. There is a reproduction of the procedure from the above mentioned article. The following instructions are for use of the Multi-Channel Analyzer for counting the standard and sample(s) for getting your results.

GFR One Sample Method

(See Figure 9-8.)

1 At the <Patient Definition> window, enter a new patient and choose the appropriate GFR One Sample or Two Sample test for an existing patient, or enter a new patient and choose the appropriate GFR test.

2. Click on the Hematology Counting tab to bring up the counting screen. Verify that the patient and ID# are correct.

3. Click on <Preferences> and find the standard to dilution ratio and quantity used to count for both the standard and the ultra filtrate. If you wish to enter any parameter, it should be done before counting. Now click <OK> to close the GFR parameters window. Any changes will now be implemented.

4. Clear away any radioactive sources from near the well counter. If you have not calibrated the well counter today, do so now.

5. Place a test tube or vial similar to what you were using for the other samples to be tested into the well counter. This will be used for background testing.

6. Click on <Background> and the system will proceed to count background. When done counting, it will display the counts and the CPM.

7. Remove the background counting vial from the well counter and place the standard into the well counter. Click on <Standard> to count the standard. When done counting, the system displays the counts and the CPM.

8. Click on <Inject> to enter the time and date of injection. If you click on <Now>, it will bring the time and date to the current date and time. You can then change this to whatever is appropriate. Click on <OK> to set the date and time.

9. Click on <Time /Sample 1> and enter the time that the sample was drawn. Once you have entered the time for the sample, click <OK> to record it. If you do not wish to save it, click <Cancel>.

   NOTE: The GFR procedure calls out for a 3 hour sample withdrawal following the injection of the pharmaceutical.

10. Place the sample into the well counter and click on <Sample>. The system will now count the sample for the appropriate time and, when finished, display the counts and CPM.

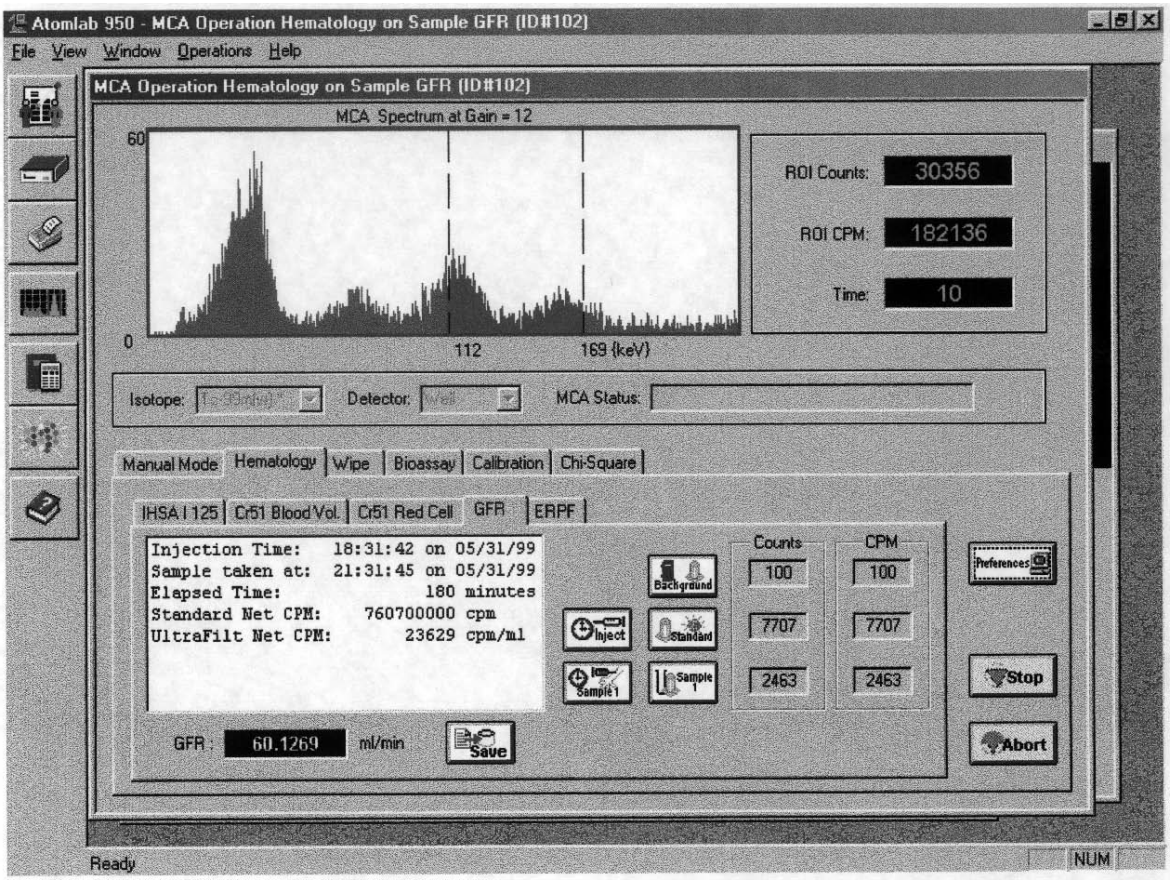


Figure 9-7. The GFR Counting Page.

11. The "Verified Test Complete" window should now be displayed. Click <Yes> if you wish to permanently save the results, or <No> if you do not want to save and would like to have the ability to recount any of the various items counted or change the times.

12. Once you have recounted or corrected anything, click on <Save> to bring up the "Verified Test Complete" screen. Click on <OK> to save. This will prevent any data for this patient from being lost or having someone else inadvertently count over the values.

13. To print the results, click on the <Printer> icon. If desired, the results can show the Technologist's name and the dose activity recorded for the report. You can also enter four (4) lines of comments for the report. If you wish to preview, click <Preview>. If you wish to print, click on <Print>.

GFR Two Sample Method

(See Figures 9-8 and 9-9.)

1. At the <Patient Definition> window, enter a new patient and choose the appropriate GFR One Sample or Two Sample test for an existing patient, or enter a new patient and choose the appropriate GFR test.

2. Click on the Hematology Counting tab to bring up the counting screen. Verify that the patient and ID# are correct.

3. Click on <Preferences> and find the standard to dilution ratio and quantity used to count for both the standard and the ultra filtrate. If you wish to enter any parameter, it should be done before counting. Now click <OK> to close the GFR parameters window. Any changes will now be implemented.

4. Clear away any radioactive sources from near the well counter. If you have not calibrated the well counter today, do so now.

5. Place a test tube or vial similar to what you were using for the other samples to be tested into the well counter. This will be used for background testing.

6. Click on the <Background> button and the system will proceed to count background. When done counting, it will display the counts and the CPM.

7. Remove the background counting vial from the well counter and place the standard into the well counter. Click on <Standard> to count the standard. When done counting, the system displays the counts and the CPM.

8. Click on <Inject> to enter the time and date of injection. If you click on <Now>, it will bring the time and date to the current date and time. You can then change this to whatever is appropriate. Click on <OK> to set the date and time.

9. Click on <Sample 1 Time> and enter the time that the sample was drawn. Once you have entered the time for the sample, click <OK> to record it. If you do not wish to save it, click <Cancel>

   NOTE: The GFR two-sample procedure calls out for a 1-hour sample and 3-hour sample withdrawal following the injection of the pharmaceutical.

10. Place the sample into the well counter and click on <Sample>. The system will now count the sample for the appropriate time and, when finished, display the counts and CPM.

11. Remove the Sample 1 from the well counter and place the second sample into the well.

12. Click on the <Sample 2 Time> button and enter the time that sample #2 was withdrawn from the patient. Click <OK>.

13. The "Verified Test Complete" window should now be displayed. Click <Yes> if you wish to permanently save the results, or <No> if you do not want to save and would like to have the ability to recount any of the various items counted or change the times.

14. The "Verified Test Complete" window should now be displayed. Click <Yes> if you wish to permanently save the results, or <No> if you do not want to save and would like to have the ability to recount any of the various items counted or change the times.

15. Once you have recounted or corrected anything, click on <Save> to bring up the "Verified Test Complete" screen. Click on <OK> to save. This will prevent any data for this patient from being lost or having someone else inadvertently count over the values.

16. To print the results, click on the <Printer> icon. If desired, the results can show the Technologist's name and the dose activity recorded for the report. You can also enter four (4) lines of comments for the report. If you wish to preview, click <Preview>. If you wish to print, click on <Print>.

Your Hospital Name
Address
City, State Zip
(000) 000-0000

Glomerular Filtration Rate Report

Printed on 06/07/04 10:59

Name: wisard march **ID:** 3-03-03

Ref. Physician: **Code:**

Patient Weight:

Radiopharmaceutical Administration

Date: 03/06/03 **Time:** 11:37
Isotope: Tc-99m-DTPA **Activity (uCi):** 55.0
Detector: Well

GFR Test Results

Procedure Name: One Sample
Sample Method: One @ 3 Hours
Standard Dilution Ratio: 1:10000

Quantity of Diluted Standard Used for Counting: 0.100 ml
Quantity of Ultrafiltrate Used for Counting: 0.100 ml

	Time Stamp	Count Time (seconds)	Counts (cpm)
Lab Background	14:38 on 03/06/03	20	21
Standard	11:37 on 03/06/03	20	21615
Ultrafiltrate (182 mins.)	14:39 on 03/06/03	20	4926

Standard Net Counts: 2159400000 cpm (Corrected for dilution and sample size)
Ultrafiltrate Net Counts: 49049 cpm/ml (Sample taken at 182 minutes after injection)

Glomerular Filtration Rate = 85.1253 ml/min

Technologist:
Comments:

Physician: _____ **Date:** _____

Software version 3.36, Unit Serial # 999999

Figure 9-8. A One Sample Glomerular Filtration Rate Report.

Your Hospital Name
Address
City, State Zip
(000) 000-0000

Glomerular Filtration Rate Report

Printed on 02/02/04 08:39

Name: Sample GFR **ID:** 102

Ref. Physician: **Code:**

Patient Weight:

Radiopharmaceutical Administration

Date: 05/31/99 **Time:** 18:34
Isotope: Tc-99m-DTPA **Activity (uCi):** 5000.0
Detector: Well

GFR Test Results

Procedure Name: Two Sample
Sample Method: Two @ 1 Hr and 3 Hrs
Standard Dilution Ratio: 1:10000

Quantity of Diluted Standard Used for Counting: 0.100 ml
Quantity of Ultrafiltrate Used for Counting: 0.100 ml

	Time Stamp	Count Time (seconds)	Counts (cpm)
Lab Background	18:35 on 05/31/99	60	100
Standard	18:34 on 05/31/99	60	5788
Ultrafiltrate (60 mins.)	19:34 on 05/31/99	60	2876
Ultrafiltrate (180 mins.)	21:34 on 05/31/99	60	964

Standard Net Counts: 568800000 cpm (Corrected for dilution and sample size)
Ultrafiltrate Net Counts: 27760 cpm/ml (Sample taken at 60 minutes after injection)
Ultrafiltrate Net Counts: 8640 cpm/ml (Sample taken at 180 minutes after injection)

Glomerular Filtration Rate = 107.0 ml/min

Technologist: Sharon Johnson
Comments:

Physician: _____ **Date:** _____

Software version 3.36, Unit Serial # 11111

Figure 9-9. A Two Sample Glomerular Filtration Rate Report.

Effective Renal Plasma Flow (ERPF)

(See Figure 9-10 and 9-11.)

The ERPF procedure in the Biodex Medical Spectrometer is based on the Journal of Nuclear Medicine, Volume 30, Number 12, December 1989, entitled, "Estimation of Technetium-99m-MAG3 Plasma Clearance in Adults From 1 or 2 Blood Samples" by Charles D. Russell, Andrew Taylor and Dennis Eshima, Div. of Nuclear Medicine, Univ. of Alabama, Birmingham V.A. Medical Center.

The Biodex program is designed to do the calculations for ERPF using the formula and procedures discussed in the above mentioned article. The following instructions describe how to count and obtain the correct results using the Biodex Medical Spectrometer. \

The Technetium-99 Mag 3 Renal Function Study: For the single sample method, a plasma sample must be obtained between 35 and 55 minutes after injection. It is recommended to use a 44 or 45 minute time for withdrawing the blood sample.
The following procedures are for counting and getting results for the ERPF study.

1. From the <Patient Definition> window, choose ERPF as the study that will be performed. This can be done with either a new patient or an existing patient.

2. At the counting page, verify that the patient and patient ID# are correct.

3. Click on <Preferences> to access the ERPF parameters. Verify that the parameters are correct. If you wish to make any changes, do so before counting. The Mag 3 conversion factor should be set up as a study default if desired in the procedure window. Once the parameters are set, click on <OK> to save them.

4. Place the background counting vial into the well counter. Click <Background> to begin counting background. When done counting, the system displays the counts and the CPM.

5. Click on <Injection> and enter the time that the Mag 3 was injected into the patient. Click <OK> to return to the counting page.

6. Remove the vial for background from the well counter and insert the standard counting vial into the well. Click on <Standard>count the standard for the designated period of time. When counting is complete, the count and CPM will be displayed and entered on the system.

7. Click on <Time / Sample 1> to display the window for entering the blood sample withdrawal time. Once you have entered the correct blood withdrawal time, click <OK> and proceed with the study.

   NOTE: It is recommended to save test results before leaving this patient and screen.

8. Remove the standard from the well and place the sample into the well. Click on <Sample> for the system to proceed to count the sample. When counting is complete, the system will display the results on the screen for both counts and CPM.

9. When the system has finished counting and displays the results for the sample, it will also display the "Verified Test Complete" message. You can now save the study by clicking on <Yes>, or if you click <No>, you can go back and make changes to the times that the samples were made or recount any of the items counted. Once you are satisfied with the results, click <Save> to display the "Verified Test Complete" screen and then click <Yes> to save the results.

10. To print a report, click on the <Printer> icon to display the report window. If desired, enter the technologist's name, activity used, and add comments to the report in this mode before printing.

11. Once counting had been completed, you can proceed to do any other studies desired.

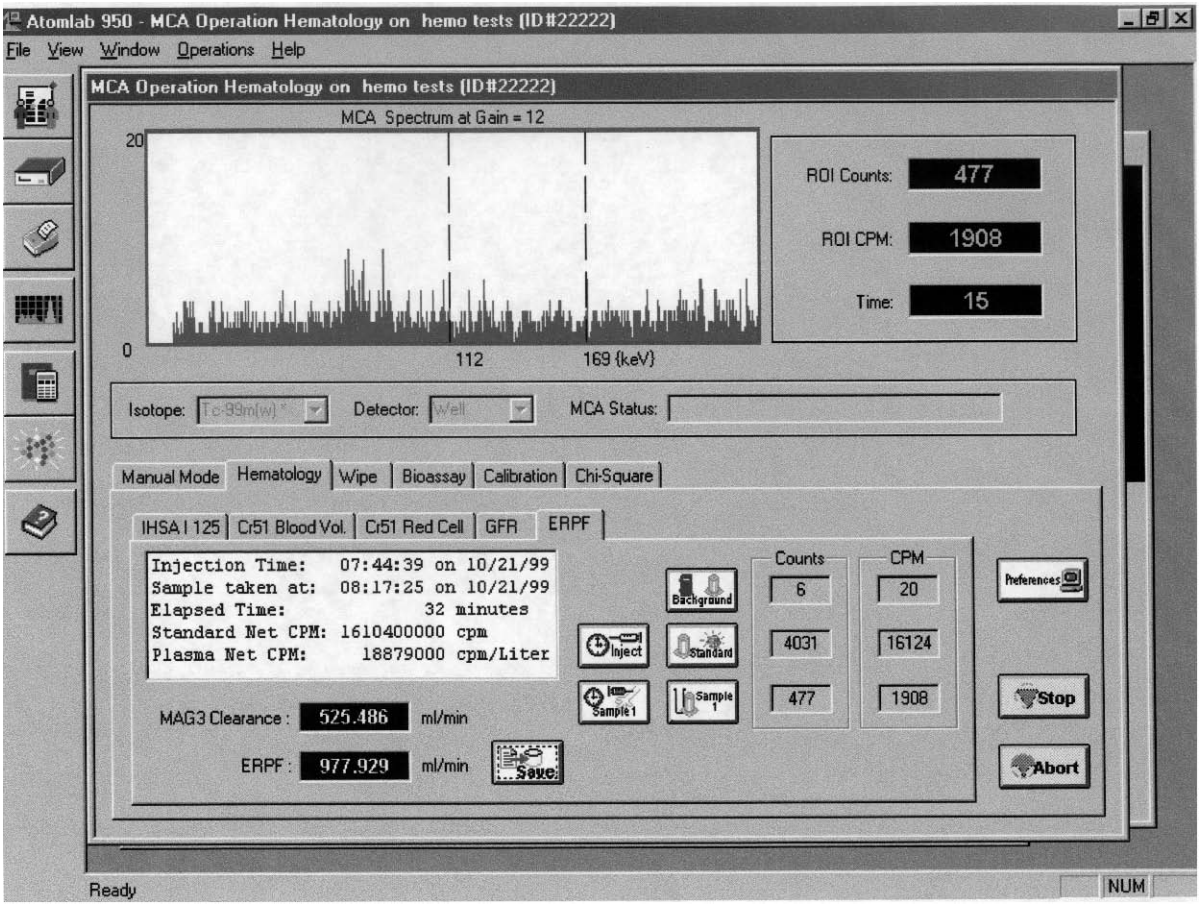


Figure 9-10. The ERPF Counting Page.

The following procedures are for counting and getting results for the ERPF study.

1. From the <Patient Definition> window, choose ERPF as the study that will be performed. This can be done with either a new patient or an existing patient.

2. At the counting page, verify that the patient and patient ID# are correct.

3. Click on <Preferences> to access the ERPF parameters. Verify that the parameters are correct. If you wish to make any changes, do so before counting. The Mag 3 conversion factor should be set up as a study default if desired in the procedure window. Once the parameters are set, click on <OK> to save them.

4. Place the background counting vial into the well counter. Click <Background> to begin counting background. When done counting, the system displays the counts and the CPM.

5. Click on <Injection> and enter the time that the Mag 3 was injected into the patient. Click <OK> to return to the counting page.

6. Remove the vial for background from the well counter and insert the standard counting vial into the well. Click on <Standard>count the standard for the designated period of time. When counting is complete, the count and CPM will be displayed and entered on the system.

7. Click on <Time / Sample 1> to display the window for entering the blood sample withdrawal time. Once you have entered the correct blood withdrawal time, click <OK> and proceed with the study.

   NOTE: *It is recommended to save test results before leaving this patient and screen.*

8. Remove the standard from the well and place the sample into the well. Click on <Sample> for the system to proceed to count the sample. When counting is complete, the system will display the results on the screen for both counts and CPM.

9. When the system has finished counting and displays the results for the sample, it will also display the "Verified Test Complete" message. You can now save the study by clicking on <Yes>, or if you click <No>, you can go back and make changes to the times that the samples were made or recount any of the items counted. Once you are satisfied with the results, click <Save> to display the "Verified Test Complete" screen and then click <Yes> to save the results.

10. To print a report, click on the <Printer> icon to display the report window. If desired, enter the technologist's name, activity used, and add comments to the report in this mode before printing.

11. Once counting had been completed, you can proceed to do any other studies desired.

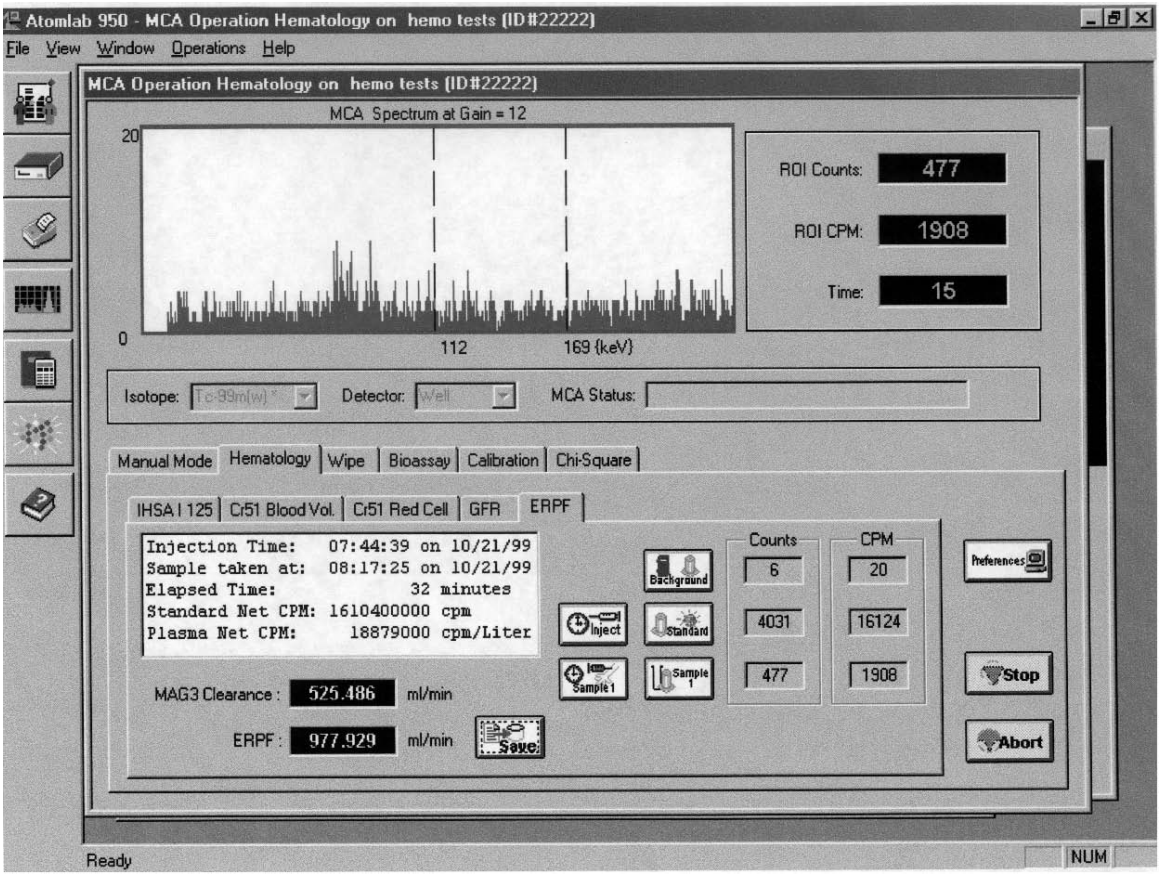


Figure 9-10. The ERPF Counting Page.

Your Hospital Name
Address
City, State Zip
(000) 000-0000

Effective Renal Plasma Flow Report

Printed on 02/02/04 08:39

Name: Sample ERPF **ID:** 103

Ref. Physician: **Code:**

Patient Weight:

Radiopharmaceutical Administration

Date: 06/01/99 **Time:** 14:20
Isotope: Tc-99m-MAG3 **Activity (uCi):** 5000.0
Detector: Well

ERPF Test Results

Procedure Name: MAG3
Sample Method: One Sample 35-55 min.
Standard Dilution Ratio: 1:10000

Quantity of Diluted Standard Used for Counting: 0.100 ml
Quantity of Plasma Used for Counting: 0.100 ml

	Time Stamp	Count Time (seconds)	Counts (cpm)
Lab Background	14:21 on 06/01/99	60	100
Standard	14:20 on 06/01/99	60	4926
Plasma Sample (50 mins.)	15:10 on 06/01/99	60	853

Standard Net Counts: 482600000 cpm (Corrected for dilution and sample size)
Plasma Net Counts: 7530000 cpm/Liter (Sample taken at 50 minutes after injection)

MAG3 Clearance: 311.4 ml/min
MAG3 to ERPF Conversion Factor: 1.8610

Effective Renal Plasma Flow = 579.6 ml/min

Technologist: jessica parrish
Comments:

Physician: _____ **Date:** _____

Software version 3.36, Unit Serial # 11111

Figure 9-11. An Effective Renal Plasma Flow Report.

APPENDIX A

ISOTOPE EFFICIENCY CALCULATION

Your new Atomlab 950 features a 2" x 2" Tube Assembly configuration. The Operations Manual provides examples of geometric efficiency in Appendix A are based on a tube assembly diameter of 1.75". For the new 2" diameter Tube Assembly, the example values provided for geometric efficiency should read as follows:

If the wipe or calibration source is placed 1/2" from the probe, the G.E. = 27.6%
For X = 0.25", G.E. = 37.9%,
For X = 0.75", G.E. = 20.0%

NOTE: The Atomlab 950 is shipped with the Isotope Efficiency screen set to centimeters (see page 3-12 and Figure 3-10). The system can be set to centimeters, inches or any other unit of measure, as long as it is consistent for the diameter and distance. Please verify that the set-up in the Isotope Efficiency page is set to match the 2" diameter tube supplied with this unit.

NOTE: 2" diameter = 5.08 centimeters
1.75" diameter = 4,445 centimeters

When the Administration Mode set-up function is changed on the Isotope Efficiency page, the set-up associated with the detector in the wipe and bioassay programs is automatically altered to match. It is vital that you verify the correct geometric efficiency to ensure readings obtained in the wipe and bioassay programs will be correct.

A. Geometric Efficiency (G.E.)
The value for Geometric Efficiency (G.E.) is calculated from the following equations for a well and probe:

WELL:

$$G.E._{WELL} = \frac{1}{2}\left(1+\frac{1}{\sqrt{1+\left(\frac{ID}{2X}\right)^2}}\right) * 100\%$$

I.D. = Inner diameter of the well opening
X = Depth into the well, measured from the top surface

Example: The Biodex Nal well dimensions have an I.D. = 0.75 inches and a well depth of 1.432 inches. When the wipe (or calibration source) is placed in the well, the isotope emitting radiation will not be at the very bottom. If we take the isotope position to be 1 inch from the top, then G.E. = 96.82%.
(For X = 1.25 inches deep, G.E. = 97.89%
For X = 0.75 inches deep, G.E. = 94.72%, which are +1.07% and -2.1% respectively, from 1 inch.)

PROBE:

$$G.E._{PROBE} = \frac{1}{2}\left(1-\frac{1}{\sqrt{1+\left(\frac{OD}{2X}\right)^2}}\right) * 100\%$$

O.D. = Outer diameter of the probe
X = Distance from the probe

Example: The Biodex Nal probe O.D. = 2.00 inches. When the wipe (or calibration source) is placed .5 inch from the probe, then G.E. = 27.64%.
For X = 0.25, G.E. = 37.9%
For X= 0.75, G.E. = 20.0%

From these two examples, you can see that the well is at least 4 to 5 times more efficient for wipe test counting than the probe and is less dependent upon wipe positioning errors.

The Atomlab 950 is shipped with the Isotope Efficiency screen set to centimeters (see pages 3-12 and Figure 3-10). The system can be set to centimeters, inches or any other unit of measure, as long as it is consistent for the diameter and distance. *Please verify that the set-up in the Isotope Efficiency page is set to match the 2" diameter tube supplied with this unit.*

B. Detector Efficiency (D.E.)

D.E. can be calculated theoretically from system parameters or can be empirically determined by measuring the count rate from a known activity of each isotope. The empirical method results in a composite value (G.E. * D.E.) which can be reduced to D.E. by dividing by the calculated value for G.E. Only the empirical method will be discussed below. The theoretical (analytic) method is discussed (Item E) following an example calculation.

C. Efficiency Values for Wipe Testing

All isotopes for which wipes are to be counted shall either be prepared from a known liquid concentration or if possible, a standard source can be purchased in a wand form from various manufacturers. Generally, the isotopes Cs-137, Co-57, Co-60, Ba-133, and Am-241 are available in wand form with a stated activity and uncertainty. The activity should be kept in the range of 0.01 to 0.1 µCi, and should not exceed 0.2 µCi. This will generally keep the overall counting rate below 10,000 cps and will eliminate any spectrum distortion or non-linearity from playing a role in the efficiency calculation.

A suggested procedure for source preparation is outlined on the next page. The liquid source will be deposited on an absorbent material in the bottom of a plastic vial which fits inside the well. It is recommended that no more than 10 ul of liquid be dispensed in order to reduce spilling radioactive material.

NOTE: If a probe is being tested for efficiency, a method for holding the source or vial in proximity of the probe, approximately one (1) cm, must be arranged and then the following procedure followed with modification as needed. If a greater distance is used then you must increase activity according to the inverse square law.

Source Preparation:

1. Prepare an activity of 0.1 to 0.01 mCi of the isotope in 10.0 ml of saline. This will result in a concentration of approximately 0.01 to 0.001 mCi/ml. The volume should be either controlled as close as possible to 10.0 ml or precisely measured.

2. Assay the activity in the vial in a dose calibrator which has a resolution of 0.01 µCi. Compensate for background before making the measurement. Record the time of measurement.

3. Calculate concentration by dividing the measured activity by the source volume and record with the time of measurement.

4. Prepare the vial with absorbent material (such as a portion of a wipe pad or the end of a Q-tip) at the bottom of the vial.

5. Draw off 10 ul of source material and carefully place the end of the syringe tip at the bottom of the vial. Deposit all of the source material onto the absorbent material.

6. Withdraw the syringe and immediately rinse it in saline at least ten (10) times. This will reduce the chance of contamination of the next source which will be a different isotope.

7. Record the activity in the test vial as $A_{Xx\text{-}123}$ at the time T is recorded in step 2. (The Xx-123 subscript is meant to designate the isotope symbol which should be recorded, i.e., Am-241.)

NOTE: *A tuberculin syringe is not suitable in this procedure. Hamilton microliter syringe, model 701-N, has a capacity of 10 ul with 0.2 ul resolution and will provide the necessary precision. Hamilton Co., P.O. Box 10030, Reno, Nevada, 89520. Phone: 800-648-5950.*

After the source preparation, the efficiency can be measured by counting the source in the Administration Mode "Isotope Efficiency" page of the Atomlab 950.

D. Efficiency Measurement

1. Make sure the Atomlab 950 has a current Cs-137 calibration.

2. Then go to the "Isotope Efficiency" page. Use the arrow keys <previous> or <next> to display the isotope you wish to set the efficiency for.

3. Set the Geometric Efficiency using the buttons near the top right of the display. (See Administration Mode in manual for directions.)

4. At the top left of the screen is an isotope activity calculator. Enter the source calibration time and activity. If you press <Show Current Activity> button, the unit displays the calculated decayed activity of the standard you created.

5. Now near the bottom of the display screen, click the mouse on the <well>.

6. Perform an automatic 100 second background count with an empty well by clicking on the <Calculate Efficiency> button to the right of the displayed detector efficiency values.

7. When the background count is completed, if you wish to manually calculate detector efficiency, record the counts in the ROI as (B). The display will direct you to place the standard into the well and press <Adjust>. The system will now perform an automatic 100 second count on your prepared standard. The system displays the spectrum as it counts.

   NOTE: The A950 system will automatically record and calculate for you.

8. If you wish to manually calculate the efficiency, record the counts in the ROI as (S). (Proceed with step 10 for Manual Calculation.)

9. Click the mouse on Accept and the system will automatically calculate and display the isotope detector efficiency.

   NOTE: Total efficiency is a combination of the geometric and detector efficiencies.

10. Calculate the composite efficiencies D.E. * G.E. using one of the following equations:

$$D.E. * G.E. = \frac{\frac{(S - B)\ counts}{100\ sec}}{A_{\mu Ci} * 37000_{dps/\mu Ci} * 2^{\frac{(T-t)}{T_{1/2}}}} * 100\%$$

OR

$$D.E. * G.E. = \frac{\frac{(S - B)\ counts}{100\ sec}}{current\ activity\ displayed} * 100\%$$

S and B are defined in steps 7 and 8 under Efficiency Measurement.

A is the activity determined in step 7 under Source Preparation for isotope Xx-123 with units of microcuries.

Exponent of "2":

This is a decay correction. For short lived isotopes such as Tc-99m, it is important. For long lived isotopes such as I-125, it may not be important unless the source is saved for future efficiency checks.

$T_{1/2}$ is the half life of isotope Xx-123, in units of H, days, etc.

T and t are respectively the time of source measurement in the dose calibrator and the same of counting the source in the well detector. Both should have the same units as $T_{1/2}$.
For example:
If T = 08:31 h and t = 15:49 h, then T - t = -7.300 h.
If $T_{1/2}$ = 3.261 days for Ga-67, then T - t should be converted to days = -0.3041 days. In this case, the decay result would be 0.937.

11. Calculate D.E. from the composite (D.E. * G.E.) found in step 10 above and from the calculated value of G.E. found earlier in the discussion on GEOMETRIC EFFICIENCY. The following equation defines the calculation.

$$D.E. = \frac{(G.E. * D.E.)}{G.E.} * 100\%$$

Note that the two terms (D.E. * G.E.) and G.E. are both calculated as percents in the earlier expressions and the above result preserves D.E. as a percentage.

Example Calculation:
Determine the detector efficiency of Am-241 in a well detector with an opening of 0.625 inches and the source located in the well at 1 inch below the surface.

Geometric Efficiency for a Well: I.D. = 0.625 inches
X - 1.00 inch

G.E. = 97.7% (see earlier example)

Detector Efficiency for Am-241: A = 0.095 µCi @ T = 8/15/84
$T_{1/2}$ = 432.2
t = 5/1/93 (date counted in well)

Am-241 was programmed for gain of 12 and an ROI of 50 to 69 keV.
100 second counts resulted in the following:
S = 99,403
B = 83

Now calculate the individual parts of the equation for (D.E. * G.E.)

Count rate = (S-B)/100 s = 993 cps

Disintegration rate = A µCi * 37000 dps/µCi = 3515 dpm

Decay Correction = $2^{(T-t)T_{1/2}} = 2^{(84.71\ y - 93.42\ y)/432.2\ y} = 0.986$

D.E. * G.E. = 0.286 * 100% = 28.6%

D.E. = {(D.E. * G.E.)/G.E.} * 100% = (28.6/97.7) * 100 = 29.3%

We should now check our result for common sense. The photon emission from Am-241 are 59.5 keV at 35.9% intensity and 26.3 keV at 2.4% intensity. The interaction probability for a 60 keV photon is very high in the Nal well detector (Nal thickness on sides and bottom is about 0.625 inches), the bulk of this interaction will be photoelectric which puts most of the counts recorded in the photo peak. The ROI is set to integrate the photo peak of 59.5 keV. Therefore, we would expect a detector efficiency to be a little less than photon intensity at 59.5 keV which it is.

Example of a Well Compared to a Probe for Counting Efficiency
If we assume the following parameters:

Isotope: Cs-137

D.E. Probe: 9.86%
D.E. Well: 13.47%

G.E. Well: 96.816% for a source placed 2.54 cm deep in the well
G.E. Probe: 0.278% for a source placed 21 cm in front of the probe

Probe: D.E. * G.E. = 9.86% * 0.278% = .02741%

Well: D.E. * G.E. = 13.47% * 96.816% = 13.04%

A.) If the detector counts 54 cpm that is equivalent to the following dpm for the parameters listed above.

Probe: 54 cpm/.02741% = 197,008 dpm

Well: 54 cpm/13.04% = 414 dpm

E. Analytically Determined (Theoretical) Detector Efficiencies

The following table of 25 isotopes contains analytically determined efficiency values for use with this instrument. Stated with the efficiency value is lower and upper region of interest for which the efficiency is valid. In the wipe test program, these ROI's are fixed and cannot be adjusted. Therefore, these efficiency values may be used in the wipe test program of this instrument instead of empirically determining the efficiency for each isotope.

NOTE: It is recommended that you empirically determine the detector efficiency of your system, the analytically determined values are approximations.

The detector efficiency "D.E." is a composite number which allows conversion from detector counts to disintegrations for a given isotope. Three factors affect it:

1. The photon intensity in the isotope decay scheme defines the number of photons which are emitted per 100 disintegrations of the isotope. This number can be less than or greater than 100% as exhibited by Cr-51 (~10%) and Co-60 (~200%). The photon energy and percent abundance in the decay scheme can be found in "Table of Radioactive Isotopes" by Edgardo Browne and Richard B. Firestone, pub John Wiley & Sons, 1986, ISBN 0-471-84909-X.

2. The photon interaction in the detector will produce counts which integrate to a fraction of the total number of photons passing through the detector. This will always be less than 100% and will depend upon the window thickness which the photon detector must pass through, detector crystal geometry and the photon energy. This photon interaction has been calculated using "Nal (TL) SCINTILLATION DETECTORS", published by Bicron, manufacturer of the probe and well detectors. This publication contains two sets of curves which were used in the calculation of detector efficiency: Figure 14 "Absorption Efficiency of Nal (TL)" for various thicknesses of Nal, and Figure 17 "X-Ray and Gamma Transmission Through Bicron Detector Windows" for various window thicknesses.

3. The ROI setting in the MCA determines the fraction of the MCA counts which are accumulated. Normally the ROI is adjusted around the photo peak, however, there can be several photon energies which are not included in this ROI because they may have a low emission intensity or their energies may cover a range too broad to be practical for background subtraction. The photo peak contribution to the photon calculation in the Nal crystal was calculated using "GAMMA-RAY ABSORPTION COEFFICIENTS FOR ELEMENTS 1 THROUGH 100 DERIVED FROM THE THEORETICAL VALUES OF THE NATIONAL BUREAU OF STANDARDS", published by Los Alamos Scientific Laboratory of the University of California, Los Alamos, New Mexico, Pub # LA-2237.

The Detector Efficiency (D.E.) has been calculated for both probe and well detectors. There is a difference because the photon path length through the Nal detector is different in the two detector configurations. There are some isotopes that the well efficiency has not been analytically determined due to gamma ray summing in the well. You must use the empirical method for these isotopes. You may have to create a custom version of the isotope with a different ROI to properly count the isotope in the well.

Analytically Determined Detector Efficiencies

Please refer to this table below for Analytically Determined Detector Efficiency (%) settings on the following Atomlab products: Thyroid Uptake Models 930 and 950, Wipe Test Counter Model 450.

Isotope	Left-ROI	Right-ROI	Probe Efficiency	Well Efficiency
Na-24	1162	3167	7.8	——
K-42	1296	1754	0.9	0.4
Cr-51	272	368	6.7	4.5
Co-57	103	158	93.8	92.8
Co-58	434	933	24.1	——
Co-60	997	1533	14.2	——
Fe-59	934	1486	7.7	3.8
Ga-67	79	345	72.8	——
Se-75	102	461	148.9	——
Sr-85	437	591	32.6	18.2
Tc-99m	119	162	84.3	82.3
Pd-103	17	27	62.3	62.3
In-111	145	281	163.4	138.7
I-123	134	183	79.4	75.4
I-125	23	41	133.5	133.5
I-131	309	420	47.4	30.1
Ba-133	256	410	60.8	——
Cs-137	561	761	18.2	9.7
Yb-169	41	228	312.4	——
Ir-192	250	703	124.6	——
Hg-197	56	90	89.1	89.1
Hg-203	237	322	62.8	44.8
Ti-201	57	96	93.2	——
Au-198	349	474	46.4	28.0
Am-241	50	69	35.7	35.7
F-18	408	613	35.97	18.55

NOTE: It is recommended that users use the Empirical testing procedures for setting detector efficiency.

Revised 6/05

APPENDIX B

SPECIFICATIONS

• Industry exclusive two-year warranty
MEDICAL SPECTROMETER HARDWARE
Computer:
Atomlab 950PC:
PC for Windows® XP with P4, 3 GHz processor, 512 megabyte RAM, 40 gig HD, 48x CD-RW and 3.5" floppy drive. Equipped with: 17" Flat Color Monitor, Sound Card and Speakers, Standard Keyboard, Trackball and Hewlett-Packard Desk Jet Printer.

Multi-Channel Analyzer
Channels: 1024
Inputs: Probe and well
Spectral Resolution: FWHM 10%
Count Rate: (Maximum) 100,000 cps
Count Rate Stability: 99%
Gross Count Rate Linearity: Within 5% up to 100,000 cps
Pulse Height Linearity: Within 2% (independent of detector)
Connectors: Signal (BNC); high voltage (MHV)
Power Supply: Regulated from 775-1225 VDC at 2 mAmps
Detector High Voltage Adjustment: Automatic H.V. adjustment for both probe & well. Uses 10 mCi Cs-137 as the calibration source.

MEDICAL SPECTROMETER SOFTWARE:
Programs: Thyroid Uptake, Wipe Test, Bioassay, Schilling Test, Hematology, Administration/ QA, Manual MCA

Radionuclides:
Factory Programmed: Au-198, Ba-133, Co-57, Co-58, Co-60, Cr-51, Cs-137, Fe-59, Ga-67, Hg-197, I-123, I-125, I-131, In-111, Ir-192, K-42, Na-24, Pd-103, Se-75, Sr-85, Tc-99m, TI-201, Yb-169.
User Set: Unlimited user defined isotopes, setting ROI, half life, name, efficiency and gain.

OTHER HARDWARE:
Probe: 2" x 2" Nal (T1) integral line scintillation detector with tube base

Uptake Stand:
Dimensions: 42" l x 31" w x 62" h (106.7 x 78.7 x 157.5 cm)
Collimated Shield: Flat field collimator meeting IAEA specifications
Arm: Counterbalanced, two section arm, moves 22.5" vertically and extends 29" horizontally from stand's vertical column.
Casters: 3" maxi-lok
Weight: 296 lb (134.3 kg)

Optional:
Well Counter: 187-246
Detector: 2" x 2" Nal (T1) integral line scintillation detector with a .75" diameter x 1.44" deep well (1.9 x 3.7 cm)
Lead Shielding: 1" thick (2.5 cm)
Cover: .125" thick (.32 cm)
Connectors: Signal (BNC); high voltage (MHV)

Well Counter: 187-256
Lead Shielding: 2" thick (5 cm)
Cover: .125" thick (.32 cm)

Certification: ETL Listed to UL 2601 Std. and CAN CSA C22.2 No. 601.1-M90, and CE marked.

CE 0413

Authorized European Community Representative: Prothia, Paris, France

APPENDIX C

ELECTROMAGNETIC COMPATIBILITY

NOTE: *This MEDICAL ELECTRICAL EQUIPMENT needs special precautions regarding EMC and needs to be installed and put into service according to the EMC information provided in the ACCOMPANYING DOCUMENTS. See accompanying chart.*

NOTE: *Portable and mobile RF communications equipment can affect MEDICAL ELECTRICAL EQUIPMENT.*

NOTE: *Contact Biodex Medical Systems, Inc. for additional EMC information.*

Standard	Test Method	Range	Limits	Result
IEC 61000-3-2	Harmonics	100 Hz to 2KHz	Class A	THD = 64.86%
IEC 61000-3-3	Flicker	observation time (TP) 10 min	-	-
		max voltage change (dmax)	4%	0.55 %
		max Rel steady state voltage change (dc)	3%	0.04 %
		duration of d(t)>3%(t)	.2 sec	0.00 sec
		short term flicker Sev (PST)	1.00	0.07
		long term flicker Sev (PLT)	.65	0.07
IEC 61000-4-2	Electrostatic Discharge	Contact: 4 & 6Kv pos/neg 1pps for 10 sec Air: 2, 4, & 8Kv pos/neg 1pps for 10 sec	no degradation of performance	complied
IEC 61000-4-3	Radiated Immunity	80 MHz to 2500 MHz / 3v/m/Horiz & Vertical @ 1M	no degradation of performance	complied
IEC 61000-4-4	Electrical Fast Transient/ Burst, Power Leads	PWR Input leads .5, 1, & 2 Kv / pos & neg / 5KHz Rep Rate	no degradation of performance	complied
IEC 61000-4-6	Conducted Immunity, Power Leads	150 KHz to 80 MHz /3Vrms	no degradation of performance	complied
IEC 61000-4-8	Magnetic Immunity	3A/M RMS @ 50/60 Hz	no degradation of performance	complied
IEC 61000-4-11	Voltage Dips and Interrupts	**Int Duration** / **Pause between** / **% reduction**	no degradation of performance	complied
		Int 20msec / pause 10 sec / >95%	no degradation of performance	complied
		Int 100msec / pause 10 sec / 60%	no degradation of performance	complied
		Int 500msec / pause 10 sec / 30%	no degradation of performance	complied
		Int 5000msec / pause 10 sec / >95%	no degradation of performance	complied
CISPR 11	Conducted Emissions	150 KHz - 30 KHz, Class A, Group 1	79/73 dbuV QP 66/60 dbuV AV	complied
CISPR 11	Radiated Emissions	30 MHz – 1GHz, Class A, Group 1	30/37 dbuVm @ 10 m	complied
IEC 61000-4-5	Surge Immunity, Power Leads	1 Kv, differential, 2 Kv Commons, 1ppm, 5 Pos, 5 Neg for total of 10	no degradation of performance	complied

SCHEMATICS

Schematics provided on the following pages include:

- Schematics Controller
- Schematics MCA, '95
- Assembly, PC Board, PC Based Spectrometer 950 and 950CE

BIODEX

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